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POLLUTION OF THE INTERSTATE WATERS
OF RARITAN BAY AND ADJACENT
INTERSTATE WATERS. SESSION (2ND)
HELD AT NEW YORK, NEW YORK ON
MAY 9, 1963. TRANSCRIPT OF CONFERENCE

Public Health Service
Washington, D.C.

9 May 1963

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**TRANSCRIPT OF CONFERENCE
IN THE MATTER OF**

**POLLUTION OF THE INTERSTATE WATERS
OF RARITAN BAY
AND ADJACENT INTERSTATE WATERS**

Second Session

May 9, 1963

New York, N. Y.

TRANSCRIPT OF CONFERENCE

Conference on Pollution of the Interstate Waters
of the
Raritan Bay and Adjacent Waters, Second Session

Called by the Surgeon General, Public Health Service,
Under the Federal Water Pollution Control Act

The Public Health Service, U. S. Dept. of Health, Education, and Welfare,
the Interstate Sanitation Commission and the
State Water Pollution Control Agencies of
New Jersey and New York

New York, New York

May 9, 1963

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PRESIDING:

Mr. Murray Stein, Chief, Enforcement Branch, Water Supply and Pollution Control, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C.

PRESENT:

REGION II OFFICE, NEW YORK, NEW YORK:

Earl J. Anderson, Regional Program Director, Water Supply and Pollution Control

Dr. Harald M. Graning, Regional Health Director

Paul DeFalco, Jr., Director, Raritan Bay Project

Sylvan C. Martin, Associate Regional Health Director for Environmental Health Services

ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO:

Francis W. Kittrell, Chief, Pollution Evaluation Unit, Technical Services Branch, Division of Water Supply and Pollution Control

Ralph Porges, Deputy Chief, Technical Advisory and Investigations Section, Technical Services Branch, Division of Water Supply and Pollution Control

Harold F. Clark, Bacteriologist in Charge, Water Quality Studies, Division of Water Supply and Pollution Control

Dr. Paul W. Kabler, Chief of Microbiology, Basic and Applied Sciences Branch, Division of Water Supply and Pollution Control

ENFORCEMENT BRANCH, PUBLIC HEALTH SERVICE, WASHINGTON, D. C.:

Rheta Piere, Conference Coordinator

Peter G. Kuh, Chief, Interstate Enforcement Section, Technical Services Branch, Public Health Service

K. E. Biglane, Chief, Eastern Operations Division, Environmental Engineering and Food Protection

William A. Felsing, Chief, Field Operations Section, Shellfish Sanitation Branch

REPRESENTATIVES OF OTHER FEDERAL AGENCIES:

William H. Wechter, Sanitary Engineer, First Army Engineers, Governor's Island, New York

S. Allan Betts, U. S. Naval Ammunition Depot, Earle

Richard W. Sherman, Special Assistant for Sanitary Engineering, Third Naval District, New York

Commander W. C. Dahlgren, Third Coast Guard District, New York

Stanley Wechsler, Hydraulic Engineer, United States Army Engineer District, New York

Warren S. Landers, United States Bureau of Commercial Fisheries, Fish and Wildlife Service, Department of the Interior

REPRESENTATIVES OF STATE AGENCIES:

Roscoe P. Kandle, M.D., Commissioner of Health, New Jersey State Department of Health

Hollis S. Ingraham, M.D., Commissioner of Health, New York State Department of Health

Natale Colosi, Ph. D., Chairman, Interstate Sanitation Commission

Mitchell Wendell, Ph. D., Interstate Sanitation Commission

Thomas R. Glenn, Director, Interstate Sanitation Commission

Stanley Pinel, representing Mayor Wagner and Maxwell Lehman, First Deputy City Administrator, City of New York

Edward W. Montanari, Assistant Commissioner for Water Resources, State Conservation Department, representing H. G. Wilm, Commissioner of Conservation and Chairman of the State Water Resources Commission

William O'Leary, representing Peter Reidy, Commissioner of Public Works, New York City

Deputy Commissioner Wild, representing Peter Reidy, Commissioner of Public Works, New York City

Mr. Warren, representing the Commissioner of Parks, Newbold Morris, of New York City

Mr. Dappert, Chief, Bureau of Water Resources, New York State Health Department

Dr. George James, Commissioner, New York City Department of Health

OTHER WITNESSES:

Elizabeth M. Wallace, Director of the Oyster Institute of North America

Martin Feldman, representing North Jersey Commercial Fishermen's Association

Jack Marshall, Ekroth Laboratories

Norma Cirella, Private Citizen

James Pfafflin, representing a citizens group in New Jersey

Charles Callison, Assistant to the President, National Audubon Society, member of the President's Water Pollution Control Advisory Board

Elaine Kovessy, Legislative Assistant, Hon. John M. Murphy, Member of Congress from the State of New York (Staten Island)

SUMMARY OF CONFERENCE
(SECOND SESSION)
POLLUTION OF INTERSTATE WATERS
of the
RARITAN BAY
AND ADJACENT WATERS
(NEW YORK - NEW JERSEY)
MAY 9, 1963

SUMMARY OF CONFERENCE
(SECOND SESSION)

POLLUTION OF INTERSTATE WATERS
of the
RARITAN BAY
AND ADJACENT WATERS
(NEW YORK - NEW JERSEY)

MAY 9, 1963

The second session of the Conference in the Matter of Pollution of Interstate waters of the Raritan Bay and Adjacent Waters (New York-New Jersey) was held on May 9, 1963 in the Banquet Hall, Carnegie International Center, 345 E. 46th Street, New York, New York under the provisions of section 8 of the Federal Water Pollution Control Act (33 U.S.C. 466 et seq.). The first session was held on August 22, 1961 in New York City.

The Raritan Bay and adjacent waters which are the subject of the conference include a portion of the Narrows, the Lower Bay, and Sandy Hook Bay, the Raritan Bay, the tidal portions of the Raritan River, the Arthur Kill, and the other smaller tributaries to the named Bays.

The Lower Bay and Raritan Bay, along with Sandy Hook Bay, combine to form a triangular body of tidal water that extends inland for about 10 miles between Staten Island, New York, to the northwest, and the New Jersey shoreline to the south. The boundary between the two States passes approximately from east to west through the middle of the Lower Bay and Raritan Bay to the western end of Raritan Bay where it swings to a northerly direction and continues up the middle of the Arthur Kill. The Arthur Kill is a narrow body of water connecting Raritan Bay, at its southern end, with Newark Bay at its northern end. The Arthur Kill forms the western border of Staten Island and the eastern border of the adjacent sector of New Jersey. The water area in question comprises approximately 30 square miles, which is about equally divided between the two States. These waters form a substantial part of the New York Harbor complex.

The following conferees representing the State Water Pollution Control Agencies of New York and New Jersey, the Interstate Sanitation Commission and the U. S. Department of Health, Education, and Welfare, attended the second session:

Dr. Roscoe P. Kandle	New Jersey State Department of Health
Dr. Hollis S. Ingraham	New York State Department of Health
Dr. Natale Colosi	Interstate Sanitation Commission
Earl Anderson	U.S. Department of Health, Education, and Welfare New York, New York

Murray Stein, Chairman

U. S. Department of Health, Education,
and Welfare
Washington 25, D. C.

The following also participated in the Conference:

Charles Callison	Audubon Society and President's Water Pollution Control Advisory Board New York, New York
Norma Cirella	Staten Island, New York
Harold F. Clark	U. S. Department of Health, Education, and Welfare Cincinnati, Ohio
Paul DeFalco, Jr.	U. S. Department of Health, Education, and Welfare New York, New York
Martin Feldman	North Jersey Commercial Fishermen's Association
Jack Marshall	Ekroth Laboratories Brooklyn, New York
Edward W. Montanari	New York Water Resources Commission and State Conservation Department New York, New York
James Pfafflin	A New Jersey Citizens Group
Stanley Pinel	Administrator's Office New York, New York
Elizabeth M. Wallace	Oyster Institute of North America
Mitchell Wendell	Interstate Sanitation Commission New York, New York

The Chairman of the Conference pointed out that:

1. Under the Federal Water Pollution Control Act (33 U.S.C. 466 et seq.), pollution of interstate waters which endangers the health or welfare of persons in a State other than the one in which the discharge originates is subject to abatement under the procedures prescribed in section 8 of the Federal Act.
2. The first step of this procedure is the calling of a conference.
3. The purpose of the conference is to bring the States and the

Interstate Agency and the U. S. Department of Health, Education, and Welfare together to review the situation, to lay a basis for future action by all parties concerned and to give States, the Interstate Agency and localities an opportunity to take any indicated remedial action under State and local law.

4. At the first session of the Conference on Raritan Bay and adjacent waters, held on August 22, 1961, in Room 1105, U. S. Court House, Foley Square, New York, New York, the Department of Health, Education and Welfare agreed to undertake in cooperation with the States, the Interstate Sanitation Commission, and other Federal agencies an investigation and study to define the type of interstate pollution problems that exist in the interstate waters of Raritan Bay and adjacent waters, to include, among other things, a determination of specific pollutants and their concentration, and methods of securing the best possible water quality.

In the light of Conference statements and discussions, the conferees at the second session agreed to the following conclusions and recommendations:

- I. The States of New Jersey and New York and the Interstate Sanitation Commission have active and effective programs for the control and abatement of pollution of the waters of Raritan Bay and adjacent waters as evidenced by:
 - A. With respect to waters other than those originating in the Arthur Kill and coming through the Narrows, the New Jersey communities have been steadily improving treatment since the 1940's. At the present time, all domestic waste from New Jersey discharging into the Hudson River and upper New York Bay area have been intercepted for treatment except for a portion of Weehawken and Union City, where the construction of needed facilities is nearing completion. On the New York side, New York City, pursuant to a consent order of the Interstate Sanitation Commission dating from 1957 has been engaged in a large program of construction. The Hunts Point and Coney Island projects have been completed. Under construction are the pollution control projects of Newtown Creek and Jamaica Bay. Scheduled for early construction, pursuant to the consent order, are projects at Red Hook, Port Richmond, North River and Ward's Island. On these projects as well as those mentioned subsequently the work is done pursuant to the approval of plans and specifications by the New Jersey and New York State Health Departments.
 - B. Entrant waters from the Raritan River were improved by completion in 1958 of the Middlesex County Sewerage Authority Treatment Plant. The New Jersey Health Department and the Authority have a continuing program on further abatement of pollution of the Raritan River.
 - C. In the Arthur Kill intensive research and investigations by New York, New Jersey and the Interstate Sanitation Commission have

been underway since 1957. As a result of this effort, information has recently become available which has formed the basis for the issuance of eight orders by the State of New Jersey as follows: Elizabeth Joint Meeting, Rahway Valley Sewerage Authority, Linden-Roselle Sewerage Authority, Borough of Carteret, Woodbridge Township, Humble Oil and Refining Company, American Cyanamid, General Aniline and Film Company; and three by New York authorities as follows: Procter and Gamble, Nassau Smelting and Refining Company and the Willowbrook State School.

- D. In Raritan Bay, pursuant to an administrative order and a time-table agreement with the Attorney General of the State of New Jersey, construction of needed works at Keyport was already underway prior to the first session of this conference, and was completed in 1962. At Atlantic Highlands, Highlands, Keansburg, Union Beach, Borough of Matawan and two industrial installations, steps of either engineering or a legal nature are in progress. The Borough of Highlands is installing an automatic chlorine residual analyzer and recorder with an alarm system and is also planning to repair the outfall line which would take the effluent from Raritan Bay and discharge it to the Atlantic Ocean. The Borough of Atlantic Highlands has hired an engineer to prepare preliminary studies to enlarge the present facilities by 50 percent and has applied for Housing and Home Finance Agency planning funds. In addition the Borough is planning to install a chlorine residual analyzer and recorder with an alarm system. The Borough of Keansburg has planned for additions and alterations to this plant and they have been approved by the State Department of Health. The Borough plans to advertise for bids soon. In Union Beach a certificate of necessity has been issued to allow this community to exceed bonded indebtedness limitations. Preliminary plans have been approved by the State Health Department for a sewage system and treatment plant. The Borough of Matawan has completed construction of a new plant which was placed in operation during the last week of April 1963. Construction of a new treatment plant by the Madison Township Sewerage Authority is nearing completion with a scheduled completion date of May 1963. Plans for proposed expansion to increase the capacity of the Middlesex Sewerage Authority plant are scheduled to be completed by the latter part of 1963. The International Flavor and Fragrances Company hired an industrial waste engineer to develop treatment facilities. A feasibility report has been furnished. Pollution sources of the B. Zura Chemical Company have been eliminated by the closing of the plant.

For the New York waters concerned, the State Department of Health has completed classification studies and reports covering the subject waters. Arrangements are now being made for public classification hearings to be held in New York City during the months of June or July. Actual classification will be made by the Water Resources Commission of New York State. The classifications of

the Interstate Sanitation Commission for these waters have been in force for over twenty years.

- II. The Public Health Service, in collaboration with the New Jersey State Department of Health, the New York State Department of Health, and the Interstate Sanitation Commission will continue and complete the investigation and study of the Raritan Bay and adjacent waters in accordance with the recommendations of the conferees at the first session of the conference held on August 22, 1961.

TRANSCRIPT OF CONFERENCE

Pollution of Interstate Waters
of the
Raritan Bay and Adjacent Waters, Second Session

May 9, 1963

P R O C E E D I N G S

OPENING STATEMENT BY MR. MURRAY STEIN

MR. STEIN: The Conference is open.

This second session of the conference on pollution of the interstate waters of Raritan Bay and adjacent waters involving the States of New York and New Jersey is being held under the provisions of the Federal Water Pollution Control Act. Under Section 8 of that Act pollution of interstate waters which endangers the health or welfare of persons in a State other than that in which the pollution occurs is subject to abatement.

The purpose of this conference is to bring together the States, the interstate agency, and the Federal representatives, to lay a basis for future action and to appraise what has been done. It is also to give States and localities and industries an opportunity to indicate what action they have taken under State and local law, and to take whatever action may be appropriate under State and local law.

I think the area to be covered will be particularized in the technical reports which follow.

A first session of this conference was held on August 22, 1961, in New York City. In the light of the conference suggestions and recommendations, and so forth, the conferees unanimously agreed at the first session to the following conclusions and recommendations:

1. The Raritan Bay and adjacent waters which are the subject of the conference are interstate waters within the meaning of the Federal Water Pollution Control Act.

2. There is pollution of these waters.

3. Scientific data, taking into account a wide range of factors and technological problems, including health, conservation, water policy and uses, and industrial processes are urgently needed, and are the critical issue in further control of pollution of these waters.

4. The Public Health Service, in collaboration with the New Jersey State Department of Health, the New York State Department of Health, and the Interstate Sanitation Commission, will undertake an investigation and study of these waters to accumulate these data.

5. Cognizance is taken of the programs and the administrative machinery of the agencies of the State of New York and the State of New Jersey, and the Interstate Sanitation Commission to control pollution of these waters.

6. There has been, and continues to be, progress under plan, in abatement

of pollution of these waters.

7. The conferees welcome and appreciate the interest, support and collaboration of the Public Health Service in the collective efforts to preserve the Raritan Bay and particularly in solving the scientific problems.

8. The conferees are willing to report to the Public Health Service at appropriate intervals and the Public Health Service will report to the other conferees periodically.

9. The conference will be reconvened on the call of the Chairman one year from the present date in order to evaluate the progress made by the study and investigation and to receive the recommendations of the conferees as to further action.

Well, it is a little more than a year. This is the call of the second session of the conference, pursuant to that recommendation made at the first session. This is a conference between the Federal Government, the States of New York and New Jersey, and the Interstate Sanitation Commission.

Under the law, all of these parties can bring to the conference whomever they wish and invite them to speak at the conference.

The conferees have been designated as follows:

Dr. Hollis S. Ingraham, Commissioner of Health, New York State Department of Health;

Dr. Roscoe P. Kandle, Commissioner of Health, New Jersey State Department of Health;

Dr. Natale Colosi, Chairman of the Interstate Sanitation Commission;

Mr. Earl J. Anderson, Regional Program Director of the Public Health Service, Division of Water Supply and Pollution Control;

and my name is Murray Stein, and I am from headquarters in Washington.

In past conferences it has been found most helpful in developing conclusions and recommendations for a summary to follow a specified procedure, and I am going to suggest we do it here. Under the law we are required to prepare a summary of the conference for distribution at its conclusion. All the conferees will be invited to make statements. At the conclusion of any statement, the conferees may ask questions or make comments. The conferees will also be asked to call on their invitees, if any, and have the invitees make statements.

In addition to the summary, we are having a verbatim transcript of the conference made by Mr. Jack Rund, a Certified Shorthand Reporter. This transcript, as well as the summary, will be available at the conclusion of the conference, or as soon as it is printed after the conclusion of the conference, through the State Health Departments or the Interstate Sanitation Commission. If any of you wish copies of the summary, we suggest you may wish to get in touch

with these people.

I would suggest that, other than the conferees, all who wish to make a statement come up to the table facing me here, where we have a microphone.

With that we will proceed with calling on the Federal conferee for the conference. Mr. Anderson.

STATEMENT OF EARL J. ANDERSON, REGIONAL PROGRAM
DIRECTOR, REGION II OFFICE, NEW YORK, NEW YORK,
DIVISION OF WATER SUPPLY AND POLLUTION CONTROL

MR. ANDERSON: Thank you, Mr. Stein.

Conferees, Ladies and Gentlemen: I am Earl J. Anderson, Regional Program Director, Water Supply and Pollution Control, New York Regional Office.

It is a pleasure to be here today as a conferee. I believe that this conference will prove beneficial toward preserving a most valuable water resource in our country's largest metropolitan area.

At this time I would like to make several introductions.

First I would like to introduce Dr. Harald M. Graning, Regional Health Director, Public Health Service, Region II.

Mr. Sylvan C. Martin, Associate Director for Environmental Health Services.

Mr. Ralph Porges, Deputy Chief, Technical Advisory and Investigations Section, Technical Services Branch of the Division of Water Supply and Pollution Control.

Mr. Francis W. Kittrell, Chief, Pollution Evaluation Unit, Technical Services Branch, Division of Water Supply and Pollution Control.

Mr. Paul DeFalco, Jr., Director of the Raritan Bay Project.

We have also invited representatives from other interested Federal agencies to attend this session. As I call off each agency, will its representative please stand and introduce himself?

First, the United States Department of the Interior.

MR. LANDERS: My name is Landers. I am from the Shellfish Laboratory at Milford, Connecticut, here as an observer.

MR. ANDERSON: First United States Army Engineers.

MR. WECHTER: Mr. Wechter, Governor's Island, New York.

MR. ANDERSON: Thank you, Mr. Wechter.

United States Army Engineer District, New York City.

MR. WECHSLER: Stanley Wechsler.

MR. ANDERSON: Thank you, sir.

The Third United States Coast Guard District.

MR. ALBURN: Leonard Alburn.

MR. ANDERSON: The United States Naval Ammunition Depot, Earle, New Jersey.

MR. BETTS: Betts.

MR. ANDERSON: We also have with us this morning Miss Kovessy from Congressman Murphy's office on Staten Island.

Miss Kovessy, would you stand, please?

MISS KOVESSY: I am here as an observer.

MR. ANDERSON: Are there any other Federal agencies represented here I may have missed?

MR. SHERMAN: I represent the District Public Works, Third Naval District. My name is Sherman, Sanitary Engineer.

MR. ANDERSON: Thank you. I think that is all.

MR. STEIN: Do you want to proceed with the presentation of the Public Health Service Progress Report? I think one of the main purposes here, after a year of work, is going to be the exchange of progress reports. Mr. Anderson?

MR. ANDERSON: Fine. Following the first session of the conference concerning pollution of Raritan Bay, and at the direction of the conferees, the Public Health Service established a laboratory and project office at the Raritan Arsenal in Metuchen, New Jersey, in the spring of 1962. The laboratory facilities were obtained in February 1962, and rehabilitated, equipped and staffed to allow the undertaking of field studies in June 1962. A full-scale sampling program has been conducted from June 1962 through the present.

The progress report that will be presented today covers a period from the initiation of these studies through December 31, 1962. This report was mailed to the conferees on March 14, with a notice of the calling of this second conference.

I should like at this time to call on Mr. Harold F. Clark, Bacteriologist in Charge of Water Quality Studies, Division of Water Supply and Pollution Control of the Sanitary Engineering Center in Cincinnati, to present a summary of the Public Health Service report.

Mr. Clark.

STATEMENT OF HAROLD F. CLARK, BACTERIOLOGIST IN CHARGE,
WATER QUALITY STUDIES, DIVISION OF WATER SUPPLY AND
POLLUTION CONTROL, ROBERT A. TAFT SANITARY ENGINEERING
CENTER, CINCINNATI, OHIO

MR. CLARK: Mr. Chairman, I should like to present the summary of our report. It has been divided up into several topics, and I will cite each topic as I present it, and I will read the report, which is essentially the same report that was sent out to all the conferees. This report was sent out to all the conferees over thirty days ago for their review.

STUDY PROGRAM AND PROCEDURES

The size of the Raritan Bay Study area (more than 90 square miles) required segmentation of the investigations to permit thorough coverage of the problems' many aspects. The required basic data included:

- (1) characterization of the water quality and waste effluents;
- (2) the effect of tributary bodies of water;
- (3) effect of environmental factors;
- (4) other transient effects such as storm water runoff; and
- (5) wastes from small and large vessels.

The study was divided into a series of efforts, each designed to the sequential solution of each of these problem areas.

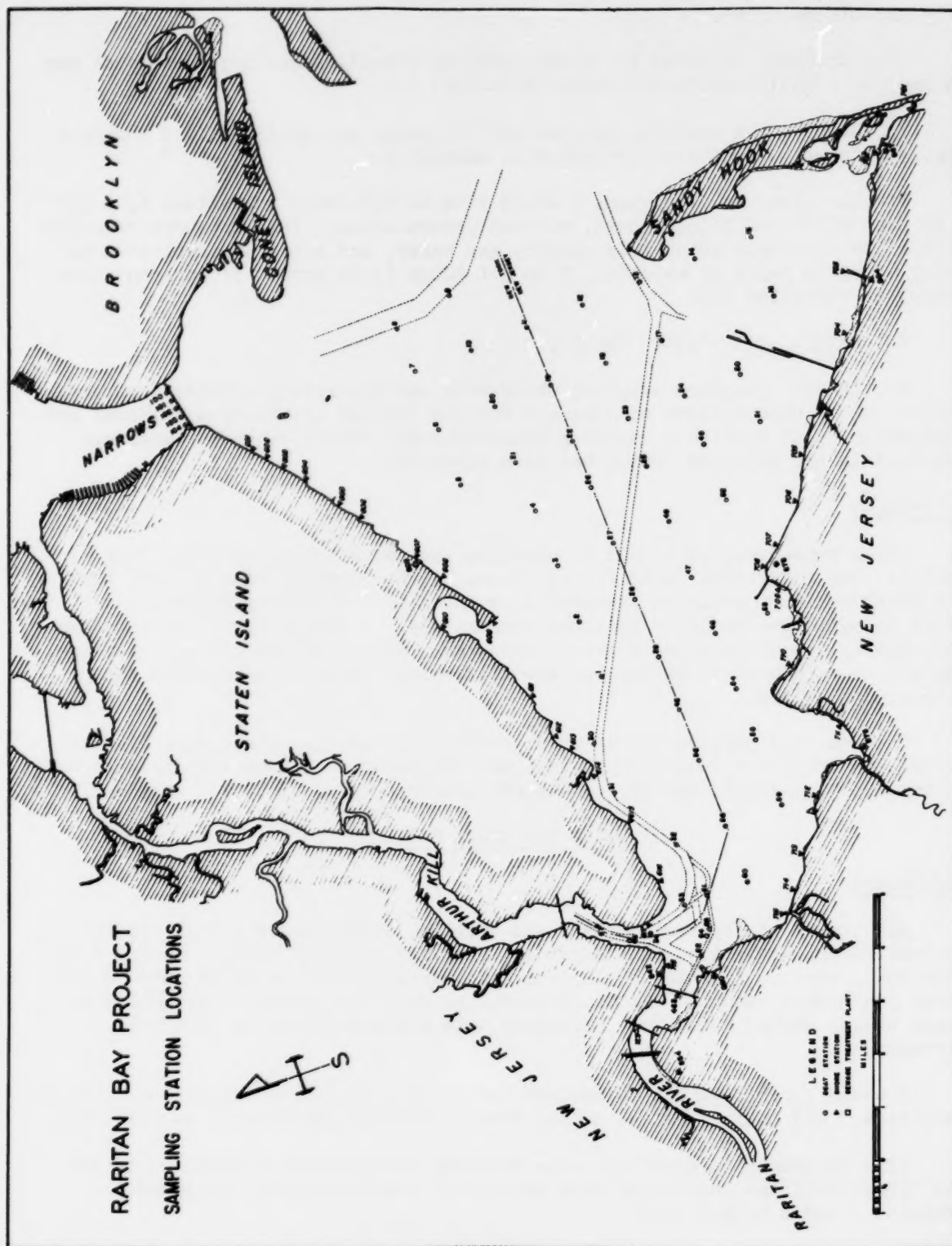
During the first year, studies were directed toward discovering the effects of water movements within the bay, and of entrant waters from the tributaries. Bacteriological, chemical and biological characterization of the bay waters was also a first-year objective--as was the characterization of the major treatment plant effluents directly tributary to the bay.

The bacteriological and chemical investigations undertaken in the bay consisted of weekly samplings at a grid of stations in the bay and along the shoreline. Simultaneous investigations were made of treatment plant effluents. Additional samplings were made at the treatment plants on a 24-hour basis to determine plant efficiencies.

I would like to submit Government Exhibit No. 1, titled "Sampling Station Locations."

MR. STEIN: All these exhibits will be accepted, without objection, and we hope to reproduce them as part of the transcript. I do not know if any of them are in color, but, as you know, we only reproduce in black and white.

MR. CLARK: All of these are in black and white, Mr. Chairman.



MR. STEIN: Fine.

(The document referred to, a map entitled "Sampling Station Locations" was marked for identification Government's Exhibit 1.)

MR. CLARK: The sampling program and locations are detailed in a separate appendix; station locations are shown in Exhibit 1.

At this time, Mr. Chairman, I would like to introduce Appendices A, B and C as part of the official record, without presentation. That appendix consists of all the data upon which this summary was based, and since it involves some fifty to sixty pages of material, I do not think it is proper for presentation except in summation form.

MR. STEIN: All right. Thank you.

MR. CLARK: Standard sampling procedures and laboratory methods were used within the recommendations of Standard Methods for the Examination of Water and Wastewater, 11th Edition. Sampling procedures and laboratory procedures are detailed in the appendix, which has been submitted.

Procedures

Three procedures were used to describe the bacteriological quality of bay waters: the "Confirmed Test" for coliforms by the multiple tube method; tests for fecal coliform group by transfer from the positive primary fermentation media to selective media at elevated temperature; determination of fecal streptococcus by use of membrane filter procedures. Random colony picks of the organisms were identified by appropriate biochemical tests in accordance with standard practices.

Chemical and physical tests used to characterize bay waters were dissolved oxygen, conductivity, chloride content and temperature. These test results were converted, by standard tables, to percent saturations of dissolved oxygen.

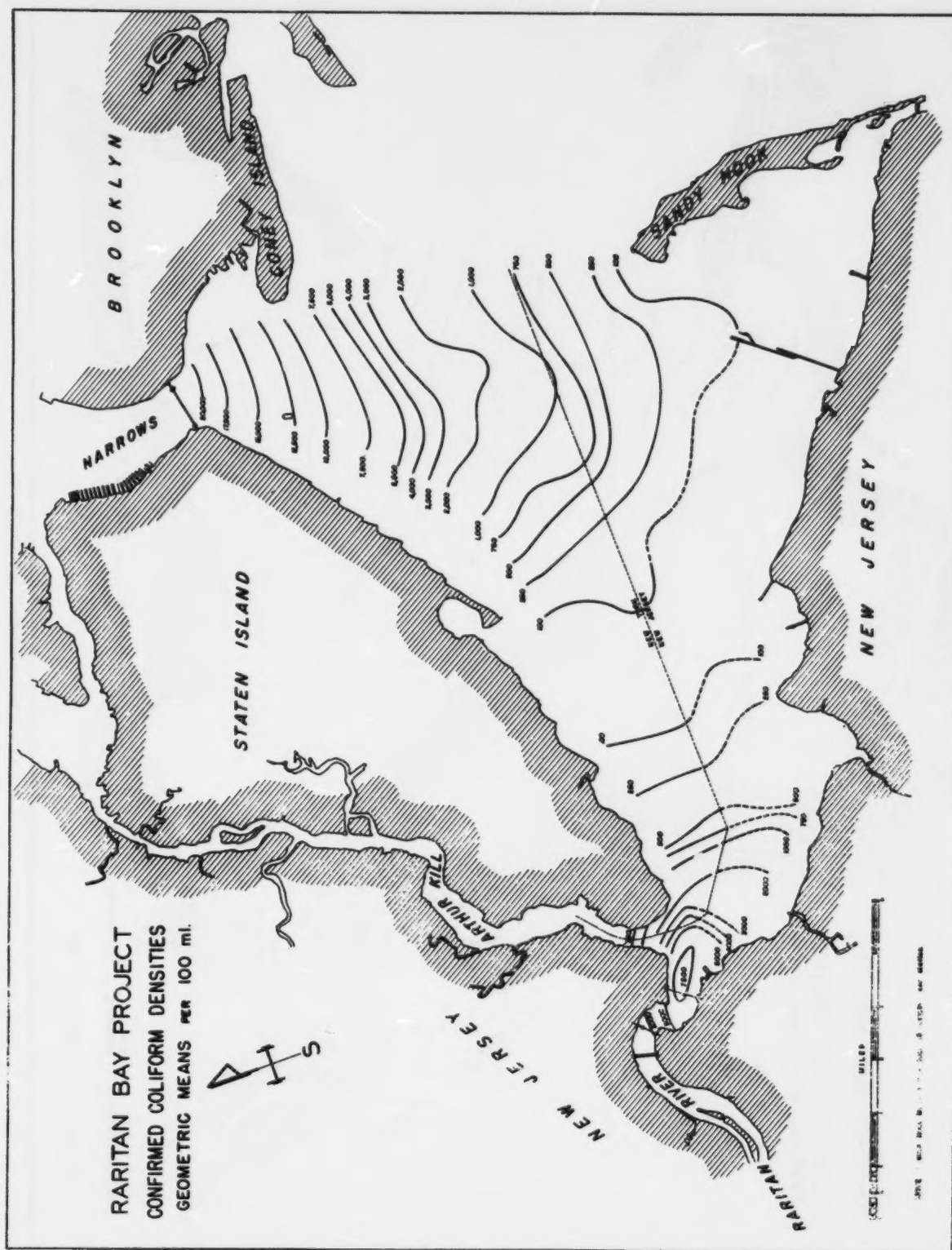
RARITAN BAY STUDY RESULTS

Bay Waters

Results of the bacteriological and chemical analyses are summarized for the present reporting period (June-December, 1962) in appendix tables; they are further summarized in a series of figures and charts similar to those used in the first conference report. All bacteriological data are presented as geometric means unless stated otherwise. Chemical data are summarized by arithmetic averages.

I would like to submit Government Exhibit No. 2, titled "Confirmed Coliform Densities," and Exhibit No. 3, titled "Fecal Coliform Densities," at this time.

(The documents referred to, maps entitled "Confirmed Coliform Densities" and "Fecal Coliform Densities" were marked for identification Government's Exhibits 2 and 3 respectively.)



MR. CLARK: Exhibits 2 and 3 present the confirmed and fecal coliform data in a series of iso-intensity lines (lines of equal density of bacterial organisms). Exhibit 2--if you will point out Exhibit 2--shows that high densities of organisms--over 1,000 per 100 milliliters--extend from the Narrows to a line running from above the Great Kills beach to the tip of Sandy Hook. High levels are also seen in the area of the junction of Arthur Kill and the Raritan River. Exhibit 3 shows substantially the same overall pattern for fecal coliforms, but in a slightly lower order of magnitude.

Would you please submit Government Exhibit No. 4, titled "Bacteriological Profiles--New York-New Jersey State Line"; Government Exhibit No. 5, titled "Bacteriological Profiles--Raritan Bay Channel"; and Government Exhibit No. 6, titled "Bacteriological Profiles--Eastern Extreme of Bay" for the record?

(The documents referred to entitled "Bacteriological Profiles--New York-New Jersey State Line", "Bacteriological Profiles--Raritan Bay Channel", and "Bacteriological Profiles--Eastern Extreme of Bay" were marked for identification Government's Exhibits 4, 5 and 6 respectively.)

MR. CLARK: Exhibits 4, 5 and 6 are graphical presentations of the following cross-sections: the bay along the New York-New Jersey State line; the Raritan Bay channel; the north-south profile of the eastern extreme of the bay from Staten Island to Sandy Hook. These figures include the geometric means of the confirmed and fecal coliforms, and of fecal streptococcus. All graphs indicate relatively high levels of organisms at the two extremities of the bay, and decreasing densities toward the center of the bay. The lowest observed levels were in the area east of Seguin Point and west of Great Kills, Staten Island. This area closely approximates the original open shellfish area.

Thirteen of the 54 stations sampled lie within the area of the original open shellfish beds. These stations do not meet the levels of water quality recommended for shellfish waters by the United States Public Health Service. Levels of fecal coliform and fecal streptococcus observed in this area would also make questionable the harvesting of shellfish from these waters for direct marketing.

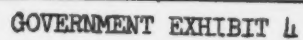
The high levels of bacterial contamination (Exhibits 4, 5 and 6) indicate that the major effects on Raritan Bay are in the area of the Narrows and the area of the junction of the Raritan River and Arthur Kill. This parallels results shown in Exhibits 2 and 3. Exhibit 6 in particular indicates material coming from the Narrows with the highest levels adjacent to the Narrows, demonstrating the significance of this source of pollution on bay waters.

Please enter Government Exhibit No. 7 at this time, titled "Dissolved Oxygen."

(The document referred to entitled "Dissolved Oxygen - Average Percent Saturation" was marked for identification Government's Exhibit 7.)

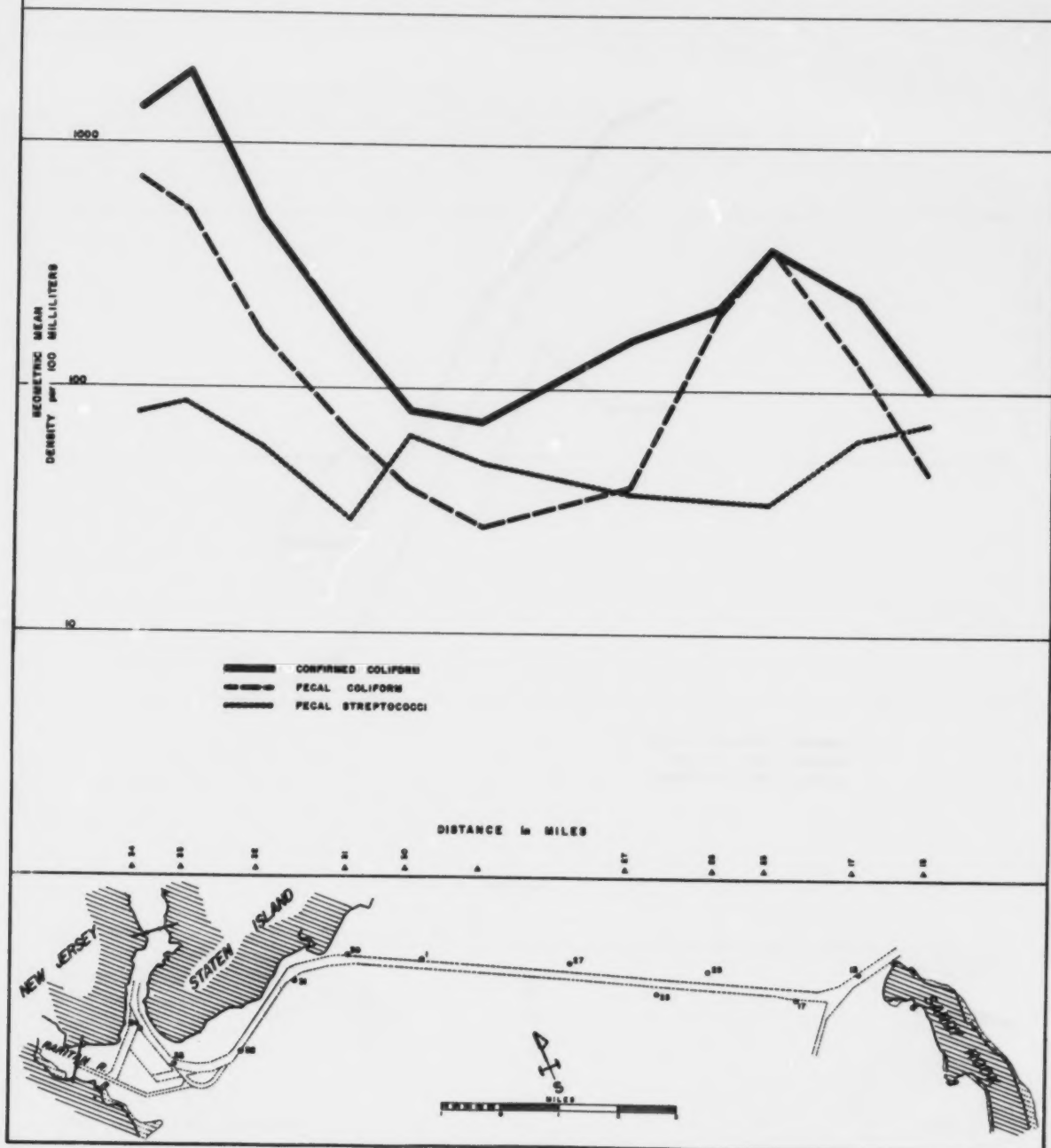
MR. CLARK: Dissolved oxygen studies were also made, concurrently with the bacteriological studies discussed above. The results are shown as arithmetic

N.Y. — N.J. STATE LINE
SAMPLE DEPTH 8'

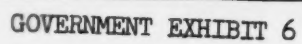


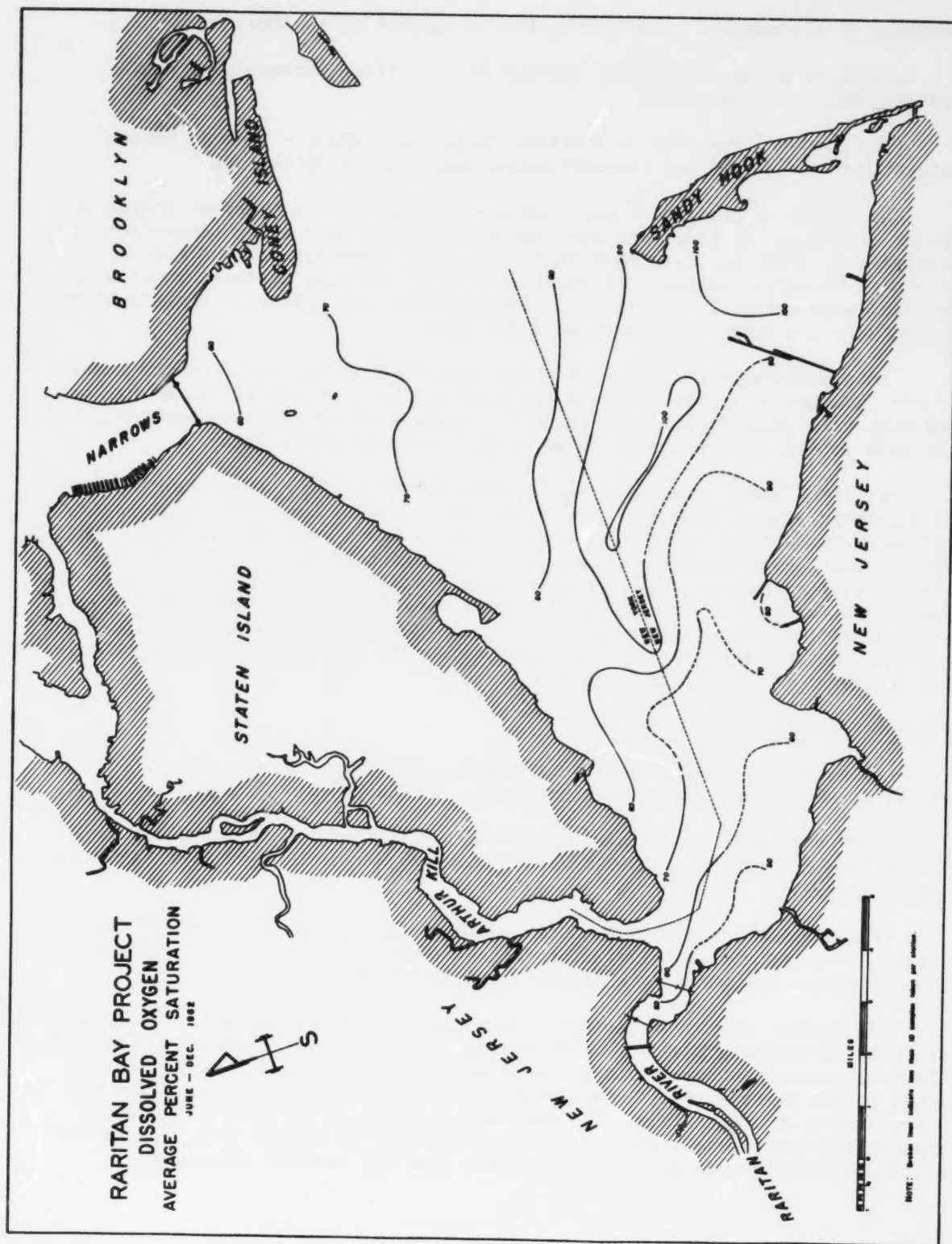
RARITAN BAY PROJECT BACTERIOLOGICAL PROFILES

RARITAN BAY CHANNEL
SAMPLE DEPTH 8'



EASTERN EXTREME OF BAY
SAMPLE DEPTH 5'





averages of all samples collected during the period of studies (Exhibit 7).

Would you submit Government Exhibit No. 8, titled "Dissolved Oxygen - Average Percent Saturation"?

(The document referred to entitled "Dissolved Oxygen - Average Percent Saturation" was marked for identification Government's Exhibit 8.)

MR. CLARK: A profile of the dissolved oxygen pattern observed during the survey of August 22, 1962--the week during which the peak water temperature was observed--is shown on Government Exhibit 8. This approximates the minimal condition of dissolved oxygen observed generally in the bay; however, local areas revealed more critical conditions during September and October. The dissolved oxygen data are summarized in an appendix table.

The considerable influence of flows from the Narrows, and from the areas of the junction of Arthur Kill and the Raritan River, on the waters of Raritan Bay proper is shown in Exhibits 7 and 8. These profiles indicate substantially the same patterns of influence shown by the bacteriological data.

Exhibit 8 shows an area in the eastern end of the bay where observed levels of dissolved oxygen were less than 50 percent. Levels less than 75 percent prevailed throughout the eastern end of the bay; a large area of the western end of the bay also showed saturation levels of approximately 50 percent. The oxygen levels observed approach, and in some cases are less than, the standards of the Interstate Sanitation Commission of not less than 50 percent saturation during any week of the year. Low dissolved oxygen levels and high bacterial densities parallel one another throughout a major portion of the bay, indicating that these two problems are closely interrelated.

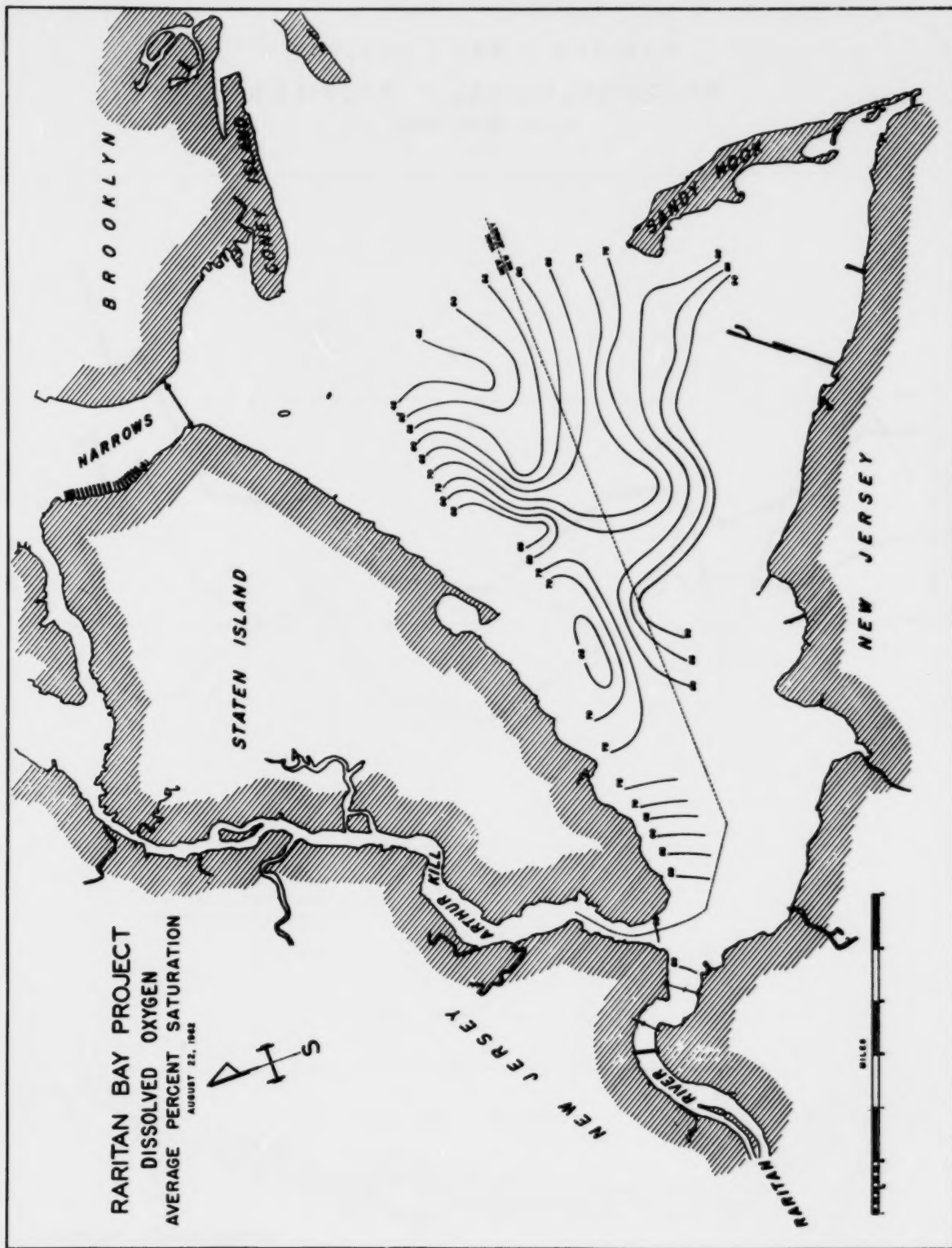
Shoreline Waters

Analyses were also conducted on samples, taken on a weekly basis, from a series of shore stations on both the Staten Island and New Jersey shorelines.

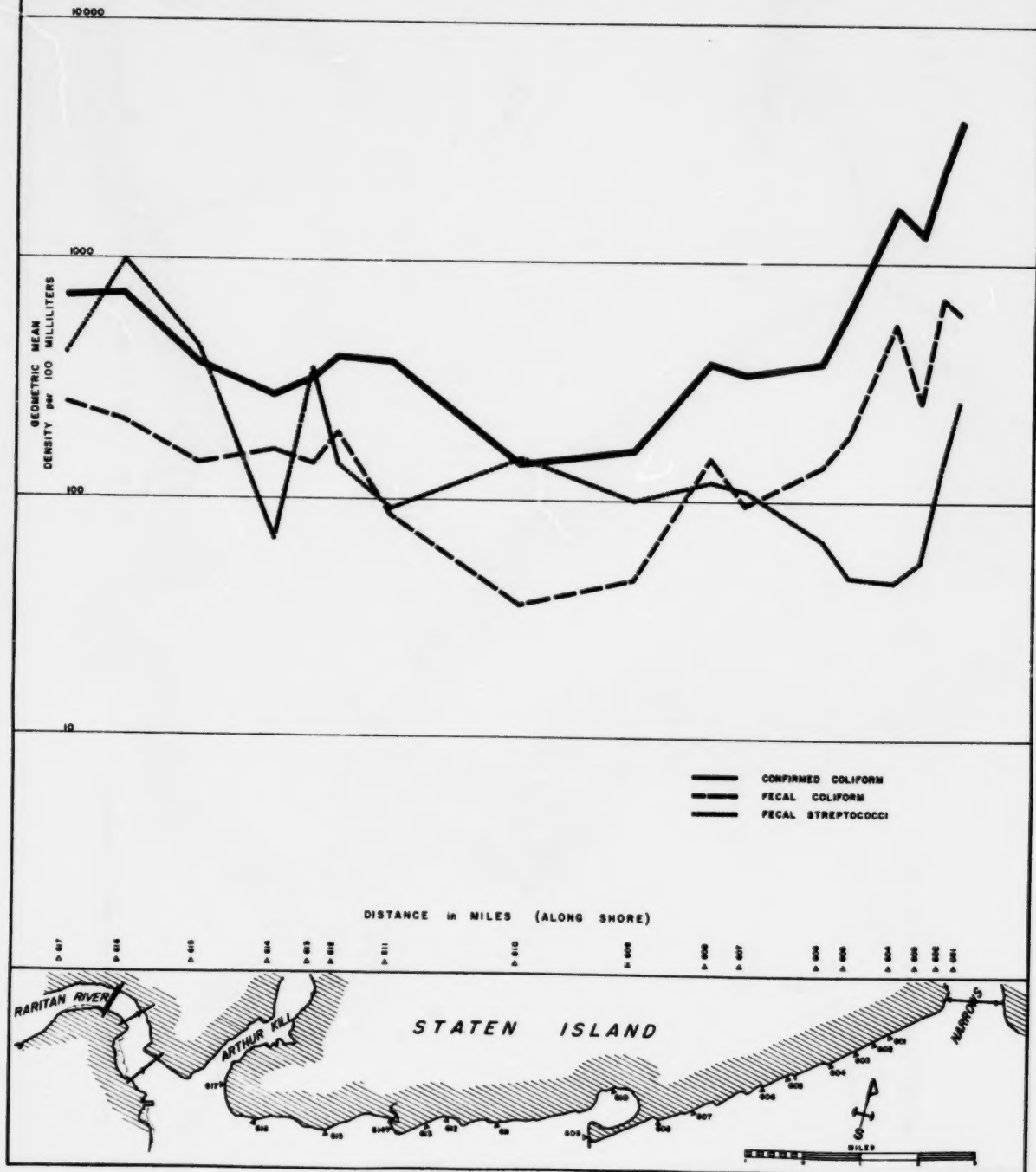
Would you submit Government Exhibit No. 9, titled "Bacteriological Profiles - Staten Island Shore" and Exhibit No. 10, titled "Bacteriological Profiles - New Jersey Shore"?

(The documents referred to entitled "Bacteriological Profiles - Staten Island Shore" and "Bacteriological Profiles - New Jersey Shore" were marked for identification Government's Exhibits 9 and 10 respectively.)

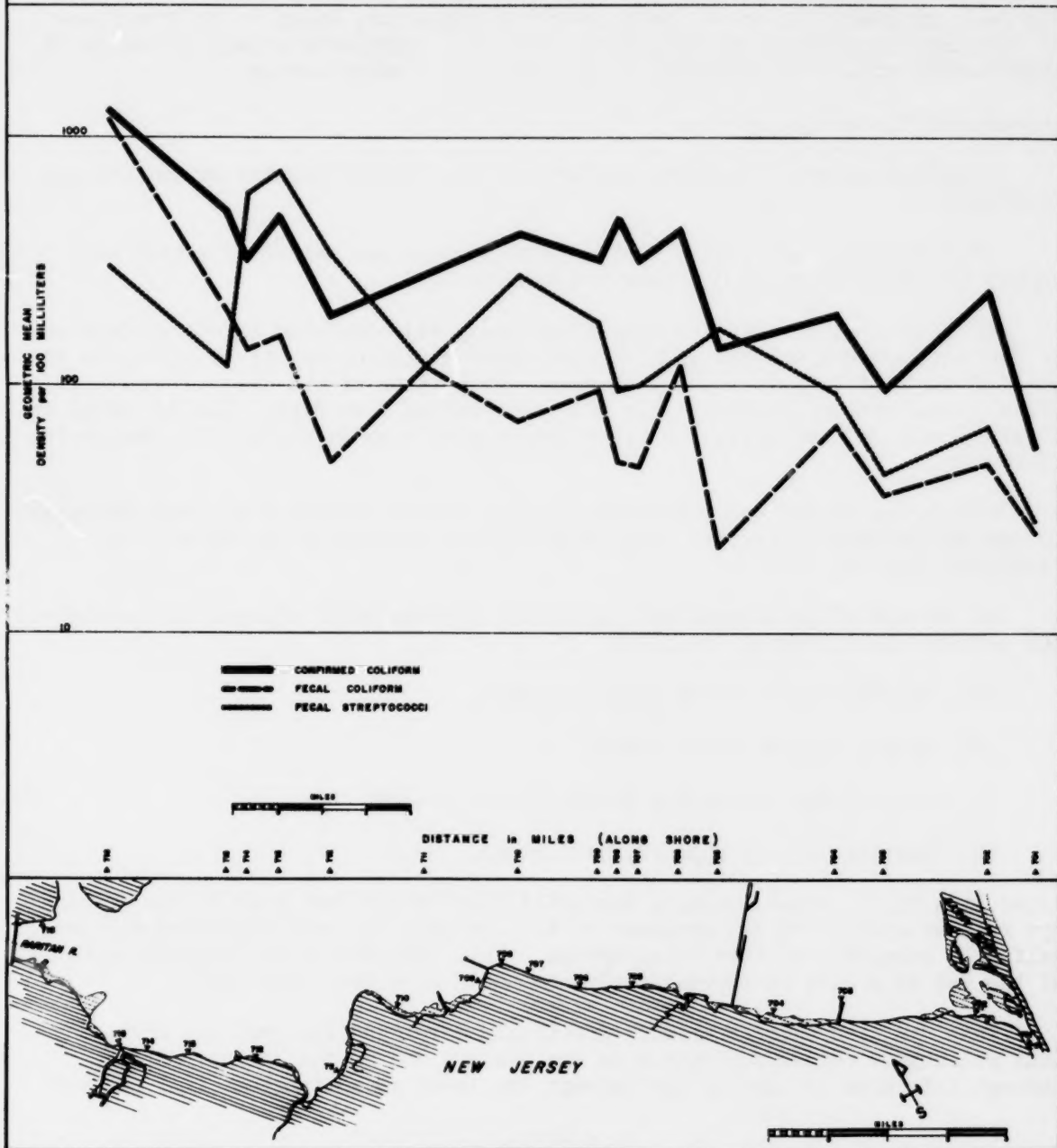
MR. CLARK: All three bacteriological indicators are summarized as graphical profiles in Exhibits 9 and 10. The Staten Island shoreline (Exhibit 9) exhibits the same general pattern of high levels of bacteriological organisms already noted in the Narrows area; lower levels occur in the central area of the bay, in the vicinity of Great Kills. The New Jersey shoreline (Exhibit 10) reveals essentially lower levels than are found on the Staten Island shoreline at the eastern extremity--but shows higher levels than the western extremity.



RARITAN BAY PROJECT BACTERIOLOGICAL PROFILES STATEN ISLAND SHORE



RARITAN BAY PROJECT BACTERIOLOGICAL PROFILES NEW JERSEY SHORE



GOVERNMENT EXHIBIT 10

A beach with a count of 1,000 or less organisms per 100 ml is classified as "approved" according to the standard used by the New York City Department of Health. Four of the sampling stations at the eastern end of Staten Island yielded counts exceeding this approved level. The bathing beach at Perth Amboy, Station 716, also exceeds this level.

It must be recognized that, in addition to the observed high coliform counts, high orders of fecal coliforms and fecal streptococcus were also encountered--in many cases of the same order of magnitude as the confirmed coliform counts. The sanitary significance of the presence of organisms, known to be from feces of warm-blooded animals and humans, is that this represents actual pollution of these waters either by untreated or inadequately treated sewage.

Current and Dispersion Studies

Would you submit Government Exhibit No. 11, titled "Dispersion and Current Studies"?

(The document referred to entitled "Dispersion and Current Studies" was marked for identification Government's Exhibit 11.)

MR. CLARK: A current and dispersion study was conducted in the western end of Raritan Bay; dye was released at high water slack, on August 15, 1962, in the area of the Ward Point secondary channel. Dispersion of the dye was monitored visually and photofluorometrically over a period of four days. The dye moved as a fairly well defined mass; the outer limits were readily discernible during the first day.

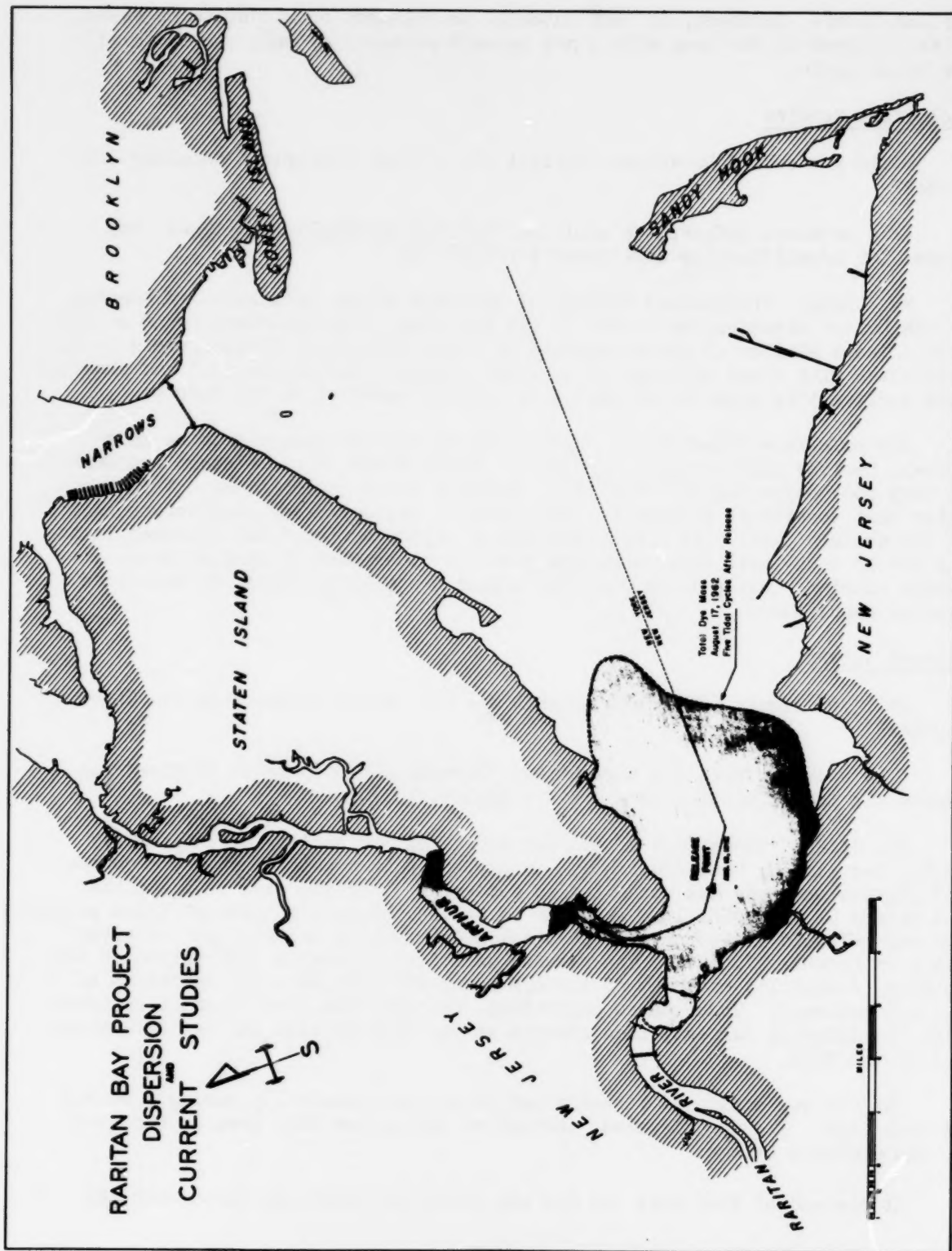
During the second and third days the dye became progressively more diffused; it was distributed laterally, longitudinally and vertically throughout the inner bay (Exhibit 11).

At the end of this three-day period the dye was still discernible throughout the area at the following locations:

- (1) The Raritan River at Victory Bridge;
- (2) Arthur Kill at Tufts Point;
- (3) Raritan Bay at Segune Point, Staten Island;
- (4) Raritan Bay off Keyport, New Jersey.

After five tidal cycles, peaking was still discernible just east of the original dye release area. The net movement of the dye mass had been approximately one-half mile seaward over five tidal cycles. This indicates a net seaward movement of the dye at a rate of approximately one-tenth mile per tidal cycle.

This dye study--together with previously developed information--indicates that pollutants released anywhere in the western end of the bay can diffuse through this area of the bay and through the lower ends of Arthur Kill and the



Raritan River. Moreover, if this material is released on a continuous basis, it is retained in the area with a net seaward movement of only one-tenth mile per tidal cycle.

Biological Studies

Would you submit Government Exhibit 12, titled "Biological Sampling Stations"?

(The document referred to entitled "Biological Sampling Stations" was marked for identification Government's Exhibit 12.)

MR. CLARK: Preliminary biological analysis of phytoplankton and benthos on the bottom organisms were made at six stations. The organisms found at Station II were similar to those reported by other biological investigators to be associated with areas polluted by domestic sewage. Bacteriological and chemical data confirm this area is influenced by entrant waters from the Narrows.

Phytoplankton found in the eastern end of the bay appeared to be in a normal, healthy physiological condition. Those found in the western end were in very poor physiological condition, based on these observations. This indicates that conditions adverse to the growth of phytoplankton populations exist in the western part. The concentrations of phytoplankton found existent in the bay are of much lower order than are found in other bays of similar size--although nutrient levels in Raritan Bay appear to be large enough to sustain a greater population.

Entrant Waters

Will you submit Government Exhibit No. 13, titled "Dispersion and Current Studies"?

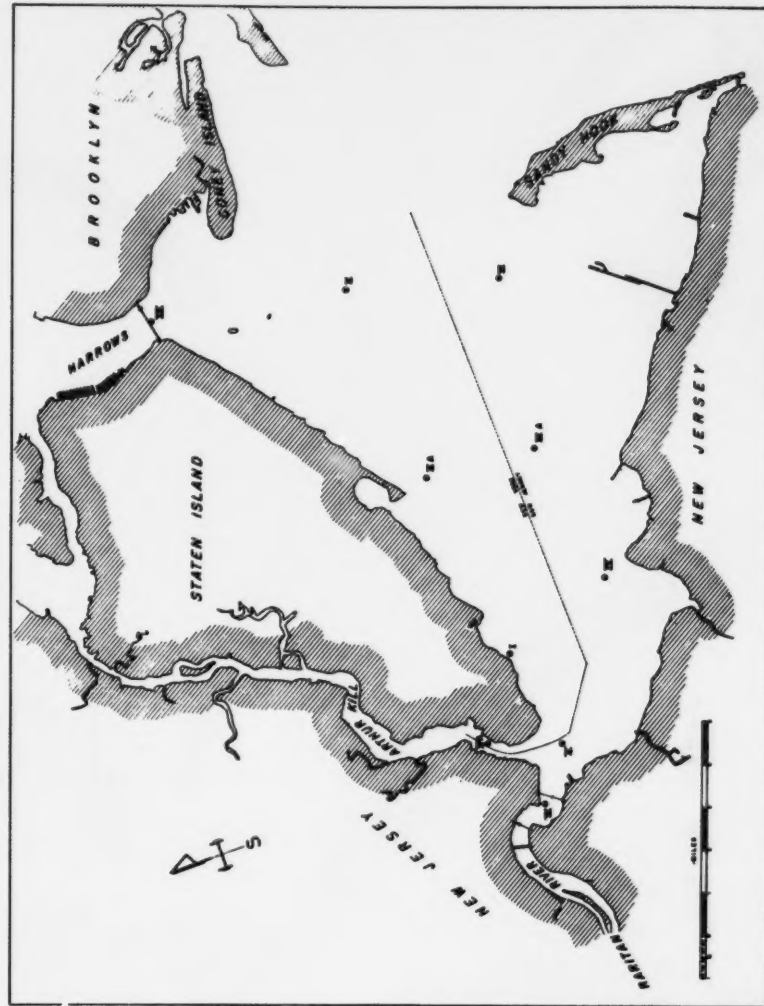
(The document referred to entitled "Current and Dispersion Studies" was marked for identification Government's Exhibit 13.)

MR. CLARK: The effect of entrant waters on the quality of Raritan Bay waters has already been discussed. To explore this problem further, a current and dispersion study was conducted to determine the dispersion of dye within the waters of Arthur Kill in order to determine the path of flow of these waters. Dye was released in Arthur Kill just below Outerbridge Crossing at low-water slack on October 17, 1962. The release was timed to enable observation of the outward (down-Kill) movement of the dye under the most adverse conditions of current movement. Under these conditions, the dye must first transit upstream with the incoming current, then reverse at the turn of tide and run downstream out of the Kill.

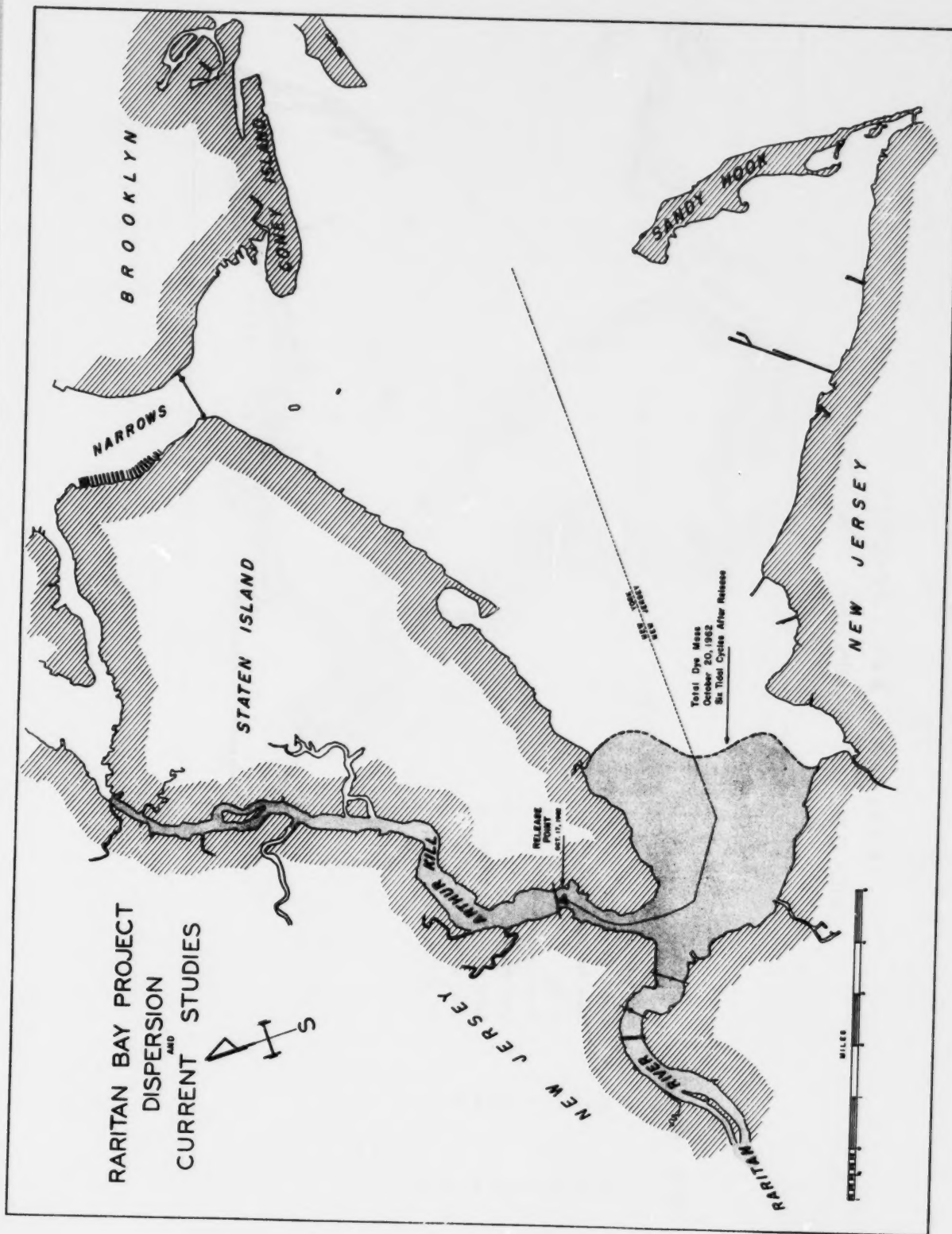
The dye was monitored visually and photofluorometrically during a period of four days. The dye dispersed throughout the entire Kill area as far north as the Goethals Bridge.

At the end of four days the dye was dispersed uniformly throughout the

RARITAN BAY PROJECT BIOLOGICAL SAMPLING STATIONS



STATION	DEPTH at MLW	LOCATION
I	15'	RED BANK
II	20'	WEST BANK LIGHT
IIA	10'	GREAT KILLS LIGHT
II	23'	CHAPEL HILL CHANNEL
IIA	10'	MID BAY
II	7'	KEYPORT HARBOR
II	12'	GREAT REES, ANCHORAGE
IIA	30'	ARTHUR MILL, TOTTEVILLE FERRY
II	12'	JERSEY CENTRAL R.R. BRIDGE
II	95'	THE NARROWS



entire western end of Raritan Bay--in the same areas and in approximately the same concentrations that were found after the dye release was made in the bay on August 15. For that you can refer back to Exhibit 11 for that data. The peak of the dye concentration (after four days) was located in the deep water anchorage southeast of Perth Amboy. The net seaward movement of the dye mass was about nine miles in a period of eight tidal cycles--approximately one mile per tidal cycle.

The entrant waters of Raritan River, Arthur Kill and the Narrows were sampled bacteriologically and chemically during the course of the project studies.

Coliform concentrations of 20,000 per 100 milliliters were found in the Narrows which were previously shown to be one of the major factors affecting the quality of water in the eastern end of Raritan Bay. The bacterial concentrations result from the release of raw or inadequately treated sewage, discharged into the waters of the upper harbor, which transit seaward through the Narrows. Currents in the Narrows displace, westward, a portion of these waters originating in the upper bay.

Low levels of dissolved oxygen were found in the Raritan River and in the southern end of Arthur Kill. These result from the discharge and decay of oxygen-consuming materials in the tributary waters.

Sewage Treatment Plants

The operations of the treatment plants tributary to the bay waters were studied by spot sampling; also 24-hour sampling was done at each of the major (over 0.25 million gallons per day) plants in the area.

Sampling sought to determine the removal efficiencies of the major treatment plants in terms of bacteriological, suspended solid and biochemical oxygen demand contents. Chlorine residuals of the effluents were also measured in order to determine disinfection effectiveness.

The results of sampling show that the Atlantic Highlands and Keansburg treatment plants failed to meet the Interstate Sanitation Commission's coliform standard of 100/100 milliliters, during 24-hour surveys, for more than 50 percent of the samples collected. The Keansburg and Atlantic Highlands plants failed to meet this standard during spot sampling checks.

The Interstate Sanitation Commission's standard for Class A waters is 6 percent reduction of total suspended solids. The Keansburg, Atlantic Highlands and Highlands treatment plants failed to meet this standard on each of the sampling occasions.

There are presently no standards existing for the discharge to Raritan Bay of biochemical oxygen demanding materials. However, Perth Amboy and Middlesex County Sewerage Authority plants contributed 95 percent of the total biochemical oxygen demand loadings from the municipal treatment plants surveyed. These two plants contribute to the depressed dissolved oxygen conditions existing in the

area of the junction of the Raritan River and Arthur Kill. Biochemical oxygen demand reductions at the Perth Amboy and Middlesex plants average 19 percent and 14 percent respectively. Considering the suspended solids reduction accomplished by these two plants, the majority of the biochemical oxygen demand is believed to be due to the dissolved and colloidal materials not ordinarily removed by primary treatment processes.

Untreated Discharges

A survey of the untreated sewage discharges to Raritan Bay disclosed two sources: toilet facilities on loading piers of the Earle Ammunition Depot, and sewers serving the Tottenville area of Staten Island.

The pier facilities of the Earle Ammunition Depot of the U. S. Navy (Leonardo, New Jersey) serve work gangs which may, at peak operations, amount to approximately 300 men on an eight-hour shift. This situation has been discussed with the Engineering Officer, Third Naval District. Chemical toilets are being installed by October 1963, which will eliminate discharge of pollution to the bay.

The other source of untreated sewage is seven sewers serving the Tottenville area of Staten Island. The drainage area of each of these outlets was determined by field investigation. The estimated tributary population is about 3,000 persons. Sewage treatment facilities for this area are under consideration by the City of New York.

I would now like to proceed to present the summary of this brief presentation.

SUMMARY

High densities of fecal bacteria were found in the waters of Raritan Bay; they were highest in the vicinity of the Narrows, the Raritan River and Arthur Kill.

High densities of fecal bacteria were found in the waters of the bathing beaches at the northern end of Staten Island and in the Perth Amboy area.

Low dissolved oxygen was observed in the waters of Raritan Bay at the confluence of Arthur Kill and the Raritan River. These dissolved oxygen levels were below the standards (50 percent saturation) set by the Interstate Sanitation Commission.

Current and dispersion studies, using dye, showed that waters of Arthur Kill have an effect on the waters of the western end of Raritan Bay. Further, dye released in the waters of the western end of Raritan Bay were found to be dispersed uniformly in this area after a period of five days.

Pollution-tolerant biological organisms were observed in the area of the bay adjacent to the Narrows. Phytoplankton concentrations, found existing in the bay, are lower than those normally found in waters of good quality.

Three treatment plants failed to meet the Interstate Sanitation Commission standard for suspended solids and coliform removal.

Approximately ninety-five percent of the total biochemical oxygen demand discharged directly to bay waters by treatment plants originates from effluents of the Perth Amboy and Middlesex County Sewerage Authority treatment plants. This load contributes to the low dissolved oxygen conditions observed in the western end of Raritan Bay.

Raw sewage from three thousand persons in the Tottenville area of Staten Island was found to be discharging to the bay.

This leads to the following conclusions:

CONCLUSIONS

These studies have demonstrated that pollution interfering with the legitimate water uses of Raritan Bay comes from:

- (1) direct discharges into the bay of inadequately treated sewage;
- (2) pollution from the upper New York Harbor entering the bay through the Narrows;
- (3) pollution entering the bay from Arthur Kill; and
- (4) pollution entering the bay from the Raritan River.

Current and dispersion studies indicated that pollution entering the water anywhere above the Outerbridge in Arthur Kill, or in the bay west of Segune Point, could diffuse in an approximately uniform manner throughout the western end of the bay, the Raritan River and Arthur Kill.

The high densities of coliform bacteria and low dissolved oxygen saturations found in the bay waters indicated conditions of pollution were present at the same levels that had existed during the 1961 outbreak of hepatitis which was traced to consumption of raw shellfish taken from these bay waters. Therefore, it can be assumed that these conditions still remain a health hazard at bathing beaches; preclude the operation of a safe shellfish industry; and, interfere with other recreational uses, including fishing and boating, of the waters of Raritan Bay.

Therefore, all four principal sources of pollution (direct discharges to the bay, the Narrows, the Raritan River and Arthur Kill) must be brought under control before the waters of Raritan Bay can be restored to their full legitimate uses for swimming, shellfish harvesting, boating, fishing, and other miscellaneous recreational purposes.

More effective treatment of present sewage discharges into the bay must be provided. All sources of pollution in the upper New York Harbor, Arthur Kill and the Raritan River, which may have deleterious effects on the waters of Raritan Bay or the use of these waters, should be identified and brought

under control.

That, Mr. Chairman, constitutes the statement.

MR. STEIN: Before we ask for comments and questions, I have one clarifying question to ask you for the record.

In your second paragraph of the conclusions where you said, "Current and dispersion studies indicated that pollution entering the water anywhere...", is the next word "below" the Outerbridge, or did you change that?

MR. CLARK: "...anywhere below the Outerbridge..."

MR. STEIN: Let the record so indicate. I think you said "above" and that might be important.

MR. CLARK: I apologize for that.

MR. STEIN: Are there any comments or questions? Dr. Kandle?

DR. KANDLE: No, sir.

MR. STEIN: Dr. Ingraham?

DR. INGRAHAM: No comments at this time. I will read a statement later.

MR. STEIN: Do you have any comments or questions, Mr. Anderson?

MR. ANDERSON: No.

MR. STEIN: Is this going to complete the presentation of the project?

MR. ANDERSON: Yes. This concludes our presentation of the project.

MR. STEIN: Just a moment, Mr. Clark. I do not know whether Mr. Clark or the Project Director is the man to answer this. I know you did have a charge from the conferees at the first conference to do this, and we have budgeted for that and gone ahead. I wonder if we can briefly indicate just what is being done for the information of the people here. I know we have a resident group. I wonder if we can outline how many people we have, the budget we have, the men on duty, and roughly the space and the equipment.

MR. CLARK: May I refer that question to Mr. DeFalco?

MR. STEIN: Yes.

STATEMENT OF PAUL DEFALCO, JR.,
DIRECTOR, RARITAN BAY PROJECT

MR. DEFALCO: In answer to your question, we have a laboratory and office facility down at the Raritan Arsenal. There are budgeted positions for thirty persons, more than half of these scientific personnel in laboratory and field work, and all phases of the sciences, such as bacteriology, biology, chemistry, and some of them involved in the hydrology of the area.

We are operating under a budget of \$250,000 per year.

The studies of the bay are approximately half-way completed at the present time. We operate a fairly intensive sampling program to develop the information that Mr. Clark has reported.

Are there any other points?

MR. STEIN: Mr. DeFalco, as I understand it, when you started this study together with the Technical Committee, you put in a time schedule on about what the study would take, and I understand you are about at the midway point in your study now?

MR. DEFALCO: That is correct.

MR. STEIN: Thank you, Mr. DeFalco.

May we call on Dr. Kandle of New Jersey? Dr. Kandle.

STATEMENT OF ROSCOE P. KANDLE, M.D.,
COMMISSIONER OF HEALTH, STATE OF
NEW JERSEY

DR. KANDLE: This is a statement presented by the Commissioner of Health for the State of New Jersey and for the several State agencies, the municipalities, the local and regional agencies and the industries concerned. The purpose of the conference according to the Introduction of the Progress Report for this Second Session of April, 1963, is "in order to evaluate investigational progress and to consider recommendations for further action."

Progress continues, as it has for more than five years, in the control and abatement of pollution of the Raritan Bay; in spite of the spurring increase in population and in industrial growth of the area. For perspective it must be reemphasized that problems of pollution are directly related to numbers and density of the people in the area and to their industrial, recreational and domestic activities. The Raritan Bay, as reemphasized by studies of the past year, is influenced importantly and directly by a large part of the massive New York City-New Jersey metropolis of some seven to eight million people, who contribute to this influence. Progress must be achieved over and above this growth and demand for this heavily used body of water. Now, in specific reference to the purpose of this conference, that is, to evaluate investigational progress, we believe that substantial progress has been made in the investigational aspects which are of such vital technical complexity.

USES

The issue of the many uses of the Raritan Bay, of the different uses for different parts of the bay and the direct influence of uses on standards and methods of control continues to require major attention, study and appraisal against continuing industrial and residential economy. Decisions regarding uses are responsibilities of State and local authorities. The maintenance of a part of Sandy Hook Bay for shellfishing is encouraging. The waters of the New Jersey bathing beaches on the southern border of the bay continue to be safe, well within quality standards, and have not been otherwise, except for temporary, local conditions.

TECHNICAL STUDIES AND TOOLS

Major advances have been made in the knowledge of these waters, the pollution problems and in the development of practical standards and technical tools of abatement. These have come about through sustained studies of the New Jersey State Department of Health, of the local agencies concerned, by the cooperative major studies with the Interstate Sanitation Commission, all supplemented by the work during the past year of the Public Health Service. There have been good cooperation and joint endeavors between the staff of the Health Department and Interstate Sanitation Commission staffs and the Public Health Service surveyors. The studies of the State Health Department and Interstate Commission have included detailed surveys with respect to shellfishing, intensive studies of the Arthur Kill including the Vicksburg Model Studies, detailed chemical and

engineering studies by the Middlesex Sewerage Authority, sanitary surveys and reviews of engineering plans of local areas, etc.

Major technical breakthroughs were achieved in the 1962-63 fall and winter which have enabled the State, the industries and the local agencies to proceed more rapidly on the basis of technically sound, practical long-range abatement plans and work. The technical report of the Interstate Sanitation Commission issued in 1962 in relation to the Arthur Kill provides a new base line for sound evaluation of the pollution load on the Arthur Kill and for actions necessary for further improvement and abatement of these waters. The report is based on studies which began in 1957.

ABATEMENT

A. ARTHUR KILL

Using the Interstate Sanitation Commission report as a guide formal orders were issued in January 1963 against eight sewerage authorities, municipalities and industries on the Arthur Kill. Substantial progress in agreements on details of abatement and active construction programs is being made. The expenditures will involve many tens of millions of dollars and may exceed \$100 million. Progress will proceed during several years.

Plants discharging sanitary sewage into the Lower Arthur Kill now chlorinate their post-treatment effluent throughout the year.

The current program is designed not only to accomplish the objectives of the Interstate Sanitation Commission report, but also to provide for continued vigilance so as to meet problems which may develop in the Arthur Kill. Additional orders may be necessary as studies proceed.

B. RARITAN RIVER

The New Jersey State Health Department issued a new statement of policy on November 13, 1962, in relation to the control of pollution of the Lower Raritan River. It is presented as Appendix A.

Based on this action, the Department has established a working agreement with the Middlesex County Sewerage Authority in relation to existing continuing sources of industrial pollution in the Lower Raritan River. This agreement provides that the Authority will, to the limits of its resources, endeavor to resolve any remaining pollution problems which can be attributed to participants in the Middlesex County Sewerage Authority project. These activities by the Authority are supported by the Department and, in any situation where the Authority finds itself unable to cope with a problem, resort is made to the State Department of Health. The State Department of Health acts directly in relation to any alleged polluters of the Lower Raritan River who are not participants in the Middlesex County Sewerage Authority project. The Department is supported in these activities by the Middlesex County Sewerage Authority.

Under this working agreement the Middlesex County Sewerage Authority

already has entered into an active program dealing with its participants who are alleged to be continuing to add to the industrial pollution load of the Lower Raritan River. Specific negotiations have been carried out with four industries.

Also pursuant to this working agreement, the State Department of Health has made investigations of sources of alleged substantial pollution and three orders have been issued. Even more importantly, nine other problems have been and are being resolved without orders. These orders are being followed up in the usual manner and will be enforced to effect their intended purposes.

The Middlesex County Sewerage Authority has continued to conduct extensive studies of its own. They have participated in cooperative projects with the State Health Department including the abatement procedures outlined. Plans for proposed expansion are expected to be completed by November 1963. A detailed statement of the operation of this Authority is presented as Appendix B.

C. RARITAN BAY

The Department, in cooperation with the Interstate Sanitation Commission, is continuing its routine program of observations of the operations of sewage treatment plants discharging more or less directly into the waters of the Raritan Bay. As usual, the Department will continue to take appropriate actions whenever findings of the Department and the Commission, separately or jointly, indicate that actions are necessary or desirable. Examples of current local activities resulting from this continuing control program are as follows:

1. Borough of Keyport: New sewage treatment facilities have been in operation since October of 1962.
2. B. Zura Chemical Company (Keyport): This previous source of pollution has been eliminated by the closure of the industry.
3. Madison Township Sewerage Authority: It is expected that the construction of the new sewage treatment plant serving the Laurence Harbor-Cliffwood Beach area will be completed approximately May 15, 1963.
4. Borough of Matawan: Construction of new sewage treatment facilities has been completed and they were placed in operation April 25, 1963.
5. Borough of Union Beach: This presently unsewered Borough has submitted preliminary plans for a collection system and treatment facility. These preliminary plans have been approved by the Department and an Order of Necessity has been issued permitting the Borough to exceed its bonded indebtedness. The design includes provision for more complete, secondary treatment.
6. International Fragrance & Flavors (Union Beach): This industry has engaged industrial waste treatment consultants to develop a program to abate its present pollution problems. A feasibility report has already been completed covering the results of certain laboratory and pilot plant experiments.

7. Borough of Keansburg: Plans for additions and alterations to the existing sewage treatment plant were approved by the State Department of Health. Advertising for bids covering the necessary construction is contemplated within the next couple of months. This is interim construction until a long-range, intermunicipal plan is further developed.

8. Borough of Highlands: Chlorination has been intensified under order. The new municipal budget contains appropriations for an automatic chlorine residual analyzer and recorder together with an alarm system. The Borough also has under active consideration the repair of the existing outfall line which, when completed, will result in the discharge of treated effluent into the Atlantic Ocean.

9. Borough of Atlantic Highlands: The Borough has under order engaged a consulting engineering firm. A preliminary study has been completed proposing to add to the capacity of the existing sewage treatment facility by 50 percent. The Borough presently has an application to the Housing and Home Finance Agency for planning monies. In addition, the Borough is considering installation of a chlorine residual analyzer and recorder together with an alarm system.

10. U. S. Naval Ammunition Depot, Earle (Pier at Leonardo): You have heard a more recent report on the United States Ammunition Depot at Earle, but I want to record that our negotiations, together with the help of the Public Health Service, have brought us the report that the funds have been budgeted for the fiscal year 1964 for modification of the sewage disposal system and the elimination of the discharge of raw domestic sewage into the Bay.

It is respectfully suggested that the conference agree:

1. That there is experienced, effective, State and interstate machinery to deal with prevention and abatement of pollution in the Raritan Bay.

2. That there continues to be good, sustained, further progress under plan in the abatement and control of pollution of the Raritan Bay by the State and Interstate agencies.

3. Knowledge about the bay and its problems have been enhanced by the studies of the State agencies, the Interstate Sanitation Commission, local agencies and by the studies of the Public Health Service. There is need still for additional research on such problems as the influence of algae, practical methods of abatement, refinements of enforcement standards. Collaborative efforts of the Public Health Service and the conferees could be effective in this type research.

(Appendix A attached to the statement of Dr. Kandle is as follows:

It is the policy of the New Jersey State Department of Health to:

1. Cooperate fully with the Middlesex County Sewerage Authority in controlling the pollution of the waters of the lower Raritan River and its tributaries within the District of the Authority.

2. Exercise the police powers vested in the Department by the laws of this State (particularly R. S. 58:12-1 et seq.) so as to restore and preserve the quality of said waters for as wide a spectrum of uses as reasonably possible.

3. Execute a program which will have as its objective the maintenance of water quality in the lower Raritan River such that the River will contribute dissolved oxygen to the Raritan Bay and such that fish life will be sustained as an indicator of River water quality.

4. Prohibit the discharge into said waters of effluents causing or threatening to cause heavy oxygen demands, extreme pH values, excessive loads of organic or inorganic materials or other unlawful polluttional effects upon the River.

5. Effect an end to the current uneven and inequitable assumption, among the municipalities and industries of the valley, of responsibility for pollution control in order that the burden for the protection of the public health and the conservation of the River may be distributed fairly.)

(Appendix B attached to the statement of Dr. Kandle is as follows:

APPENDIX B

Statement of

MIDDLESEX COUNTY SEWERAGE AUTHORITY

for

THE SECOND SESSION

THE CONFERENCE ON POLLUTION OF RARITAN BAY AND

ADJACENT INTERSTATE WATERS

May 3, 1963

* * *

The Middlesex County Sewerage Authority has provided and operated treatment facilities to produce an effluent which has met, now meets, and will continue to meet the requirements of its permit from the New Jersey State Department of Public Health.

The Authority will provide additional facilities, if necessary, to produce an effluent which will meet all the requirements of its permit. To that end, the Authority has authorized engineering and is planning to construct as soon as possible two clariflocculators which will increase its treatment plant capacity to 78 m.g.d. Because of unexpected growth, it is providing these additional facilities approximately 11 years ahead of schedule, without urging action by any pollution control agency, in accordance with its policy to provide treatment which will meet all of its obligations for pollution control.

The Authority maintains careful operation control and continuous laboratory surveillance of its effluent. The resulting data, which are filed at the Authority and available to any authorized person, are summarized below:

1. Effluent chlorine residuals - 25,280 samples per year.

In 1962, these averaged 0.90 mg/l. In 1962, chlorine residual control was improved with the result that chlorine residuals of 0.0 value were reduced from 5 percent of residuals to approximately 1/2 percent. Theoretically, 20 percent of the samples could have no residuals and still meet permit requirements for coliforms in the plant effluent.

2. Effluent coliform concentrations - 2,190 samples per year.

In 1962, 90 percent of the samples contained less than 22 coliforms per 100 ml. This is much better than the N. J. permit requirement. Effluents with coliform concentrations of 22 per 100 ml is bacteriologically suitable for swimming and edible shellfish harvesting.

3. Influent and effluent suspended solids - 2,555 samples per year.

In 1962, the percent reduction of suspended solids averaged 68 percent, 8 percent better than permit requirements.

Some of the data which are part of the average were better and some worse. The large number of samples analyzed by the Authority gives a true picture for the year. The smaller number of samples which were collected by the U. S. Public Health Service for the Progress Report distort the true picture. For example, the Progress Report, in reporting suspended solids gives the Authority credit for higher than actual removals and in reporting coliforms in the plant effluent does not give the Authority proper credit for removals.

The Raritan Bay has been legitimately used for the ultimate purification of pollution reaching it, boating, swimming, fishing, wildlife and shellfish harvesting in the past.

Shellfish harvesting is now prohibited in most of the bay because of bacteriological pollution as evidenced by coliform concentrations. These coliform concentrations in the western end of the bay are under the dominant influence of the Raritan River.

The legitimate use of the bay for the dilution and disposal of pollution reaching it and for recreation by boating, swimming, wildlife and fishing has continued and probably will in the future even though balancing such uses will ultimately require a higher degree of treatment for the increased volumes of sewage and industrial wastes which will then be discharged to Raritan Bay and other metropolitan New York-New Jersey waters. More treatment will probably be required to maintain the balance between the legitimate bay uses of purification of pollution and recreation.

The Raritan Bay receives the treated chlorinated effluent from the Authority sewage treatment plant and legitimately uses some of its purification capacity to complete the purification of the residual pollution left in the effluent. It also receives and purifies pollution from the Raritan River, the Arthur Kill, the Narrows and from many direct discharges from treatment plant effluents, such as from Perth Amboy and South Amboy and from a few untreated sanitary sewer systems, such as the one at Tottenville on Staten Island.

At present stream pollution control programs are being pushed in the Raritan River Valley, along the Arthur Kill and by the City of New York to clean up waters outside Raritan Bay. These programs when completed will reduce the pollution load on the bay and will result in a lower level of pollution and a higher level of oxygen, the only pollution parameter which has been near the minimum level permitted for boating, swimming, wildlife and fishing.

Some idea of the effect of the Arthur Kill on Raritan Bay can be seen by comparing the 38 percent dissolved oxygen saturation of waters discharging to the Raritan Bay during ebb tides and the 60 percent saturation of waters being received into the Arthur Kill from Raritan Bay during flooding tides. The effect of low oxygen concentration discharged into the Raritan Bay from the

Raritan River is illustrated by the fact that a relatively small increase in oxygen saturation of two parts per million would supply approximately 10,000 more pounds of oxygen to the bay each day.

The dissolved oxygen picture in the bay has been distorted by the effect of algae and other chlorophyll-bearing phytoplankton. When growing, they increase the oxygen content of the waters, sometimes to super-saturation but when they die and begin to decay exert large oxygen demands. The pattern of oxygen concentrations in the bay indicates that algae oxygen demand may have been a major contributor to the lower levels which were reached. The Progress Report shows marked die-off of phytoplankton in the west end of the bay in September and October 1962, the time of year when minimum dissolved oxygen concentrations have occurred. Although primary sewage plant effluents contain nutrients which will support algae growths, nutrients also come from natural river flow and are also present in large amounts in highly purified treatment plant effluents, often in a form such as nitrates which are more easily used by algae. The role of algae in the Raritan Bay oxygen levels, its source of nutrients and the effect of higher degrees of treatment on the algae must be determined before serious consideration can be given in the future to more sewage treatment to maintain dissolved oxygen levels.

The Authority and several municipalities discharging directly into the Raritan Bay have completed their pollution control programs. Other municipalities and industries on the Raritan River, the Arthur Kill and the Metropolitan New York-New Jersey area are now embarked on pollution control programs which are required to reduce pollution in other waters and which will have the double beneficial effect on Raritan Bay of reducing the pollution and increasing the oxygen discharged into it. These programs should and will improve the oxygen saturation in the bay. With the incidental effects from these other programs, the oxygen saturation in Raritan Bay should be satisfactory for several years in the future with less need for the Authority or other municipalities discharging treated effluents directly to the bay to provide a higher degree of treatment.

The Authority which completed its present pollution control program in 1958 should not have to start on a new pollution control program until completion of the existing pollution control programs in the waters discharging into Raritan Bay.)

MR. STEIN: Thank you, Dr. Kandle.

Are there any questions or comments?

DR. INGRAHAM: Not at this time.

MR. STEIN: If not, we will call on Dr. Ingraham of New York.

STATEMENT OF HOLLIS S. INGRAHAM, M. D.
COMMISSIONER OF HEALTH, NEW YORK STATE DEPARTMENT OF HEALTH

DR. INGRAHAM: Mr. Stein and members of the conference: The State Health Department has invited as participants, Mr. Wilm, who is the Commissioner of Conservation and Chairman of the State Water Resources Commission. He is represented here by Mr. Montanari. Mr. Montanari.

We have also invited Mayor Wagner and certain of his Commissioners as participants. Mayor Wagner, I believe, is represented by Mr. Pinel, who will read a statement later. Mr. Pinel.

Also there have been invited the Commissioner of Health, Dr. George James; the Commissioner of Public Works, Mr. Peter Reidy, who, I believe, is represented by Mr. William O'Leary.

MR. O'LEARY: Deputy Commissioner Wild.

DR. INGRAHAM: And Deputy Commissioner Wild.

Also we have invited the Commissioner of the Department of Parks, Mr. Newbold Morris, who is represented by Mr. Warren.

Also, representing my Department, is Mr. Dappert, who is Chief of the Bureau of Water Resources.

Mr. Stein, I have here a statement on behalf of the State Health Department, which I shall read for the record.

I am Hollis S. Ingraham, Commissioner of Health, New York State Department of Health. The statement is as follows:

The Progress Report for the Conference on Pollution of Raritan Bay and Adjacent Interstate Waters, Second Session, prepared by the U. S. Public Health Service, under "INTRODUCTION" refers to the conference held on August 22, 1961, states certain conclusions, and announces the purpose of this second session of the conference by stating:

"The conferees also agreed to reconvene in approximately one year on the call of the Chairman, in order to evaluate investigational progress and to consider recommendations of further action."

At the time of the previous conference held on August 22, 1961, I presented a statement on behalf of the then State Commissioner of Health, Dr. Herman E. Hilleboe. That statement was fairly detailed, outlined the interest, activities, and progress of the various New York State and New York City agencies in relation to the water pollution problems of the New York Metropolitan Area, and discussed some of the more troublesome problems or factors militating against any 100-percent abatement of pollution from these waters. Dr. Hilleboe's statement readily admitted that it was possible to effect improvements, but expressed some doubt as to whether it would be possible to effect

sufficient improvements to permit reopening of certain areas of Raritan Bay to shellfishing.

The statement I present to you today will:

- (1) bring you up to date concerning certain matters which were discussed in Dr. Hilleboe's original statement;
- (2) make some comments concerning the Progress Report which is under consideration today; and,
- (3) give you my thoughts as to the direction in which all of the agencies which are concerned with the problem and involved in this conference should proceed in the immediate future.

PROPOSED CLASSIFICATION OF WATERS WITHIN NEW YORK CITY
BY THE NEW YORK STATE WATER RESOURCES COMMISSION

Dr. Hilleboe's original statement discussed this matter to some extent. At this time, it is pertinent to point out that the former State Water Pollution Control Board was abolished, effective January 1, 1962. The functions of the former Board are now divided between the State Commissioner of Health and the Water Resources Commission, but coordinated, so far as policy matters are concerned, by the latter agency, of which the State Commissioner of Health is a member. Essentially, the Water Resources Commission is now responsible for classifying and reclassifying waters of the State and for assignment of quality standards thereto; and the State Commissioner of Health is responsible for enforcement of the law and for bringing pollutional discharges into compliance with the established standards.

Actually, the State Department of Health carries on all activities related to the classification phase of the State water pollution control program in practically the same fashion as in the past; it performs for the Water Resources Commission all of the work necessarily incidental and leading up to the adoption of "official classifications" by the Water Resources Commission, such as surveys, preparation and publication of reports, conduct of classification hearings in behalf of the Commission, and preparation of recommended official classifications for consideration of the Commission.

After the waters are officially classified by the Water Resources Commission, the next step is the development of a comprehensive water pollution abatement plan for the classified waters, which requires the approval of the Water Resources Commission. It should be pointed out that the Interstate Sanitation Commission has jurisdiction over the control of pollution in these tidal waters of the New York Metropolitan Area and that the State Commissioner of Health serves as a member of this Commission.

Any classification of and assignment of standards for waters in the metropolitan area by the Water Resources Commission must be consistent with those established under the Interstate Sanitation Compact; they may be higher, but not lower, than Interstate Sanitation Commission standards. Furthermore, the

State Commissioner of Health, once the waters are classified, will have authority to require abatement of pollution entering tributary fresh-water streams of the area, whereas the Interstate Sanitation Commission does not have such authority. Thus, in the abatement phase of the program, once the waters are classified by the Water Resources Commission, the efforts of the State Commissioner of Health will complement those of the Interstate Sanitation Commission in working for the abatement of pollution in the New York Metropolitan Area waters. In this respect, there will be close coordination between the State Commissioner of Health and the Interstate Sanitation Commission.

Preclassification studies have been made by the State Department of Health and reports published covering:

- (1) The Arthur Kill and Kill Van Kull;
- (2) West Lower Bay and Raritan Bay;
- (3) Upper Bay and East Lower Bay;
- (4) Harlem River;
- (5) Lower East River;
- (6) Atlantic Ocean opposite New York City; and
- (7) The Hudson River below the Westchester-Rockland County lines.

All of these reports include the entire drainage area (New York portion) tributary to the specifically designated waters.

Studies are now in progress covering the remaining water areas within New York City and Westchester County. (Jamaica Bay and Upper East River-Long Island Sound Drainage Basins)

Arrangements are now being made for public classification hearings to be held in New York City during the months of June and July in relation to classification of waters covered by the above seven published reports. In connection with these hearings, two special classes, I and II, with appropriate standards' specifications are being proposed for application to certain of these water areas. Actual classifications of these waters, of course, will be finally determined by the Water Resources Commission.

NEW YORK HARBOR MODEL STUDIES

Undoubtedly, the New York City Department of Health and the Interstate Sanitation Commission will comment upon these studies which were carried on by contract with the Corps of Engineers and financed jointly by the Interstate Sanitation Commission, the City of New York, and the New Jersey and New York State Departments of Health. Much work has already been done using this model and much more is in progress. After the results of these studies have been

evaluated, it is expected much additional information will be available.

COMMENTS CONCERNING PROGRESS REPORTS
OF U. S. PUBLIC HEALTH SERVICE

We have reviewed this report in the light of the announced purpose of this second session of the conference: "to evaluate investigational progress and to consider recommendations of further action"

1. On Page 2, the Progress Report outlines the studies carried on by the U. S. Public Health Service following the conference held on August 22, 1961.

To a considerable degree, studies along the lines listed have been carried on by several official interstate, State and city agencies. As a result, a considerable body of knowledge concerning the problems of the pollution of Raritan Bay and adjacent interstate waters has been amassed over a period of years.

The studies as made by the U. S. Public Health Service during the past year have added somewhat to this body of knowledge, but in the main have served to confirm much of what has already been known concerning these problems. It is suggested that any further studies along the same lines as those listed on page 2 of the Progress Report are not essential, with the exception, perhaps, of further biological investigations. These might furnish a background of information that could serve as a means for reflecting the improvements in water quality as progress is made in the treatment of sewage and wastes in future years.

It is suggested that cooperative studies by the various local agencies and the U. S. Public Health Service of the pollution from boat traffic might be productive of valuable information bearing on the question as to when it may be possible to reopen such areas to shellfishing.

It is suggested also that similar cooperative studies related to the pollution contributed by the numerous combined storm-sewer-relief overflows might be productive of much valuable information bearing on the problem of what, if anything, can be done to reduce or alleviate the pollution from these sources.

2. Page 3 of the Progress Report gives a summary of the findings resulting from the U. S. Public Health Service studies. We concur in general with this summary, subject only to any comments that may be made by other agencies which have been invited to appear as participants in this conference.

3. Page 4 gives the conclusions reached by the U. S. Public Health Service as a result of its studies. Subject to such comments as may be made by other agencies which are appearing as participants in this conference, we raise no questions at this time.

Two significant parts of the total problem of the pollution of Raritan

Bay constitute the pollution which is contributed by boat traffic and numerous storm-water-relief overflows from combined sewer systems.

In time, the problem of pollution from boats may be solved to some degree. However, the problem of pollution from combined sewer-storm-water-relief-overflows seems to be incapable of any real solution unless completely new sanitary sewer systems and treatment plants are built to replace the combined sewer systems as the vehicle for conveyance of all sanitary sewage, and all premises are reconnected to the separate sanitary sewer systems. In any such scheme the costs would seem to be both astronomical and prohibitive.

Of course, where space is available, it is possible to devise systems of storm-water-relief-overflow basins which would provide for a reasonable solution of this problem in specific situations.

SUGGESTED COURSE OF FUTURE ACTION

This conference, the first session of which was held on August 22, 1961, was called on the basis of the authority vested in the Secretary of Health, Education, and Welfare by one sentence contained in Section 8(c)(1) of the Federal Water Pollution Control Act, which reads:

"The Secretary shall also call such a conference whenever, on the basis of reports, surveys, or studies, he has reason to believe that any pollution referred to in Subsection (a) and endangering the health or welfare of persons in a State other than that in which the discharge or discharges originate is occurring."

It is to be noted that the conference was called solely upon the initiative of the Surgeon General and not as a result of any request of any State or water pollution control agency.

Section 8(b) of the Federal Water Pollution Control Act seems to have been overlooked to some extent. This reads:

"Consistent with the policy declaration of this Act, State and interstate action to abate pollution of interstate or navigable waters shall be encouraged and shall not, except as otherwise provided by or pursuant to court order under Subsection (g), be displaced by Federal enforcement action."

Section 8(c)(3) and Section 8(d) of the Act indicate the direction that this proceeding should take at this point. These read:

"(3) Following this conference, the Secretary shall prepare and forward to all the water pollution control agencies attending the conference a summary of conference discussions including (A) occurrence of pollution of interstate and navigable waters subject to abatement under this Act; (B) adequacy of measures taken toward abatement of the pollution; and (C) nature of delays, if any, being encountered in abating the pollution. (d) If the Secretary believes,

"upon the conclusion of the conference or thereafter, the effective progress toward abatement of such pollution is not being made and that the health and welfare of any persons is being endangered, he shall recommend to the appropriate State water pollution control agency that it take necessary remedial action..."

It seems, therefore, that the time has arrived when the Secretary should conclude this conference. And in consideration of the extensive water pollution abatement programs which are being carried on by the various agencies participating in this conference, he would have a very justifiable reason for concluding it and leave to the responsible and competent State and local agencies and the Interstate Sanitation Commission the responsibility of carrying these programs forward. Any other course of action would be distasteful to these various agencies which have demonstrated that they are competent to carry out their presently operative and planned programs.

In summary, my suggestions for the future course of action are along the following lines:

1. Bring this conference to a conclusion.
2. Allow the existing agencies to carry out their programs of pollution abatement without interference or compulsion upon the part of the Federal Government, but rather within the intended framework of cooperation and support.
3. With reference to investigational progress which is under consideration at this meeting, I believe -- with the exceptions of some further investigations relating to biology, the pollution from boat traffic, and pollution from combined sewer-storm-water-relief overflows -- no further extensive investigations are needed. These studies should be carried out by close collaboration of the various agencies and the U. S. Public Health Service.
4. The various State and local agencies and Interstate Sanitation Commission will consult periodically with the U. S. Public Health Service to keep it advised as to the progress which is being made with respect to abatement of pollution from Raritan Bay and adjacent interstate waters.

This is the conclusion of my statement. I should like to call upon the New York City Administration to present a statement on their behalf.

MR. STEIN: Would you like to entertain questions or comments now, or wait?

DR. INGRAHAM: I would prefer to wait until all of the statements are read.

MR. STEIN: Surely.

DR. INGRAHAM: Mr. Pinel.

STATEMENT OF STANLEY PINEL
REPRESENTING MAXWELL LEHMAN, FIRST DEPUTY CITY ADMINISTRATOR
CITY OF NEW YORK

MR. PINEL: My name is Stanley Pinel. I am representing Mr. Maxwell Lehman, who is the First Deputy City Administrator of the City of New York.

This statement has been prepared in conjunction with the several Departments of New York City involved in this problem. This is a statement of the City of New York at the second session of the conference on pollution of Raritan Bay and adjacent waters, May 9, 1963.

The city recognizes its obligation in relation to the raw sewage discharges at Tottenville and is prepared to proceed with the design of a treatment plant and collecting sewers to handle this small pollution load.

The City of New York is proceeding with its commitments to build all needed facilities to treat the raw sewage entering the boundary waters. Financial commitments in the year 1962 exceeded \$80,000,000. The Newtown Creek Project is scheduled for operation in 1966 and preliminary plans for North River are complete. Preliminary plans for the Red Hook Project are well along and we will start preliminary design of the Port Richmond facilities as soon as negotiations with the State of New York are completed under the State Aid Program.

The Department of Health has investigated the discharges from the Mt. Loretto Home, the Marist Novitiate, Richmond Memorial Hospital, S. S. White Dental Company, and St. Joseph's Home on Staten Island. The discharges of inadequately treated sewage have been eliminated or will be eliminated before the end of the year.

Orders were recently issued to four industrial plants and one hospital which have effluent lines discharging into Arthur Kill.

The Department of Health is continuing with its program of surveying the shorelines of all New York City waters to detect discharges of sewage. When violations of Article 145 of the Health Code are found, abatement orders are issued and are followed up until the condition is corrected.

Under sponsorship of the Health Research Council of New York City, extensive studies have been made on the Model of New York Harbor located at the U. S. Army Engineers Waterways Experiment Station at Vicksburg, Mississippi. Experiments have been conducted to show the effect of extending jetties from shoreline at Fort Wadsworth to Hoffman and Swinburne Islands in protecting Staten Island beaches and on extension of a jetty from Sea Gate. These jetty locations are shown on the attached map.

There are two maps attached to this statement.

A comprehensive analysis has been made on the movement of water from storm water overflow and treatment plant sources into the harbor -- data are being

reduced and analyzed. When the analytical report is available, there should be much information contributing to assessment of the harbor pollution problem and pointing the way to additional work that may be done by the City of New York and others to improve harbor water quality and protect beaches and recreational areas of the city.

The New York City Department of Parks has plans for placing almost the entire waterfront along the easterly shore of Staten Island in public ownership for utilization as parks and arterial highways. This is the second map. Locations of the various projects are shown on the second map attached to this statement.

Present status of progress on the plan is as follows:

1. Great Kills Park Addition -- Title to the property was vested on 12/27/62.
2. Lemon Creek Park -- Map approved and acquisition authorized with title to vest on date of final decree.
3. Wolfe's Pont Park Addition and Conference House Park Addition -- Maps and acquisition before Board of Estimate for approval.
4. Shore Drive between Great Kills Park and Outerbridge Crossing -- Map under preparation.
5. South Beach Extension -- Construction of third and last stage to be started in 1963.

Improvements for the new acquisition will be progressed as soon as funds become available to do so.

The above statement was prepared with the concurrence of all agencies concerned -- City Administrator's Office, Bureau of the Budget, Department of Public Works, Department of Health, Department of Parks.

I submit the two maps which show the park projects and the jetty locations and the harbor model.

(The maps referred to, entitled "Borough of Richmond, Department of City Planning, The City of New York, August 1956" and "Location of Special Stations" were marked for identification New York Exhibits 1 and 2 respectively.)

DR. INGRAHAM: I believe Mr. Montanari has a statement.

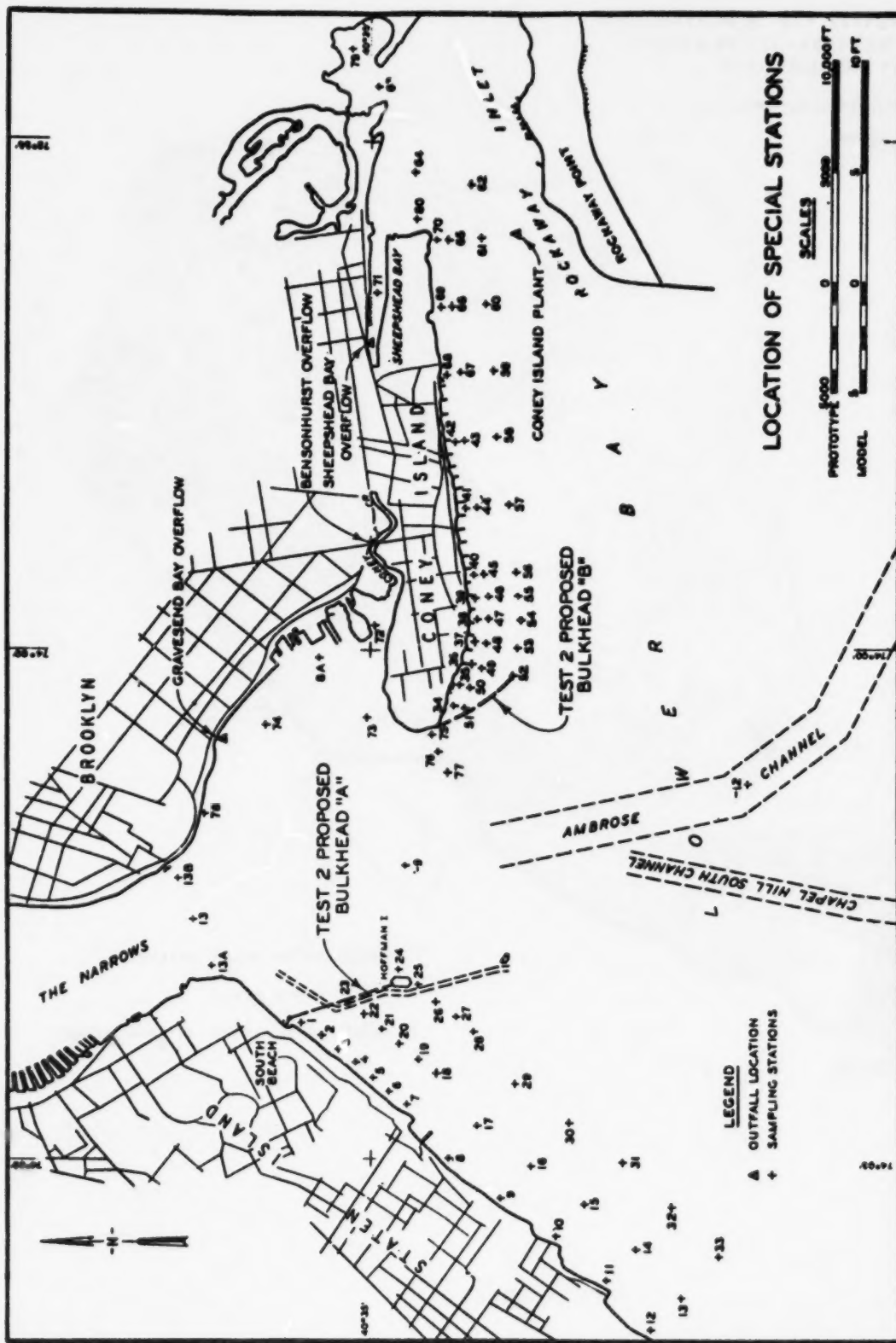
STATEMENT OF EDWARD W. MONTANARI, ASSISTANT COMMISSIONER
OF WATER RESOURCES AND THE STATE CONSERVATION DEPARTMENT

MR. MONTANARI: Mr. Chairman, I am E. W. Montanari, Assistant Commissioner of Water Resources and the State Conservation Department.

BOROUGH OF RICHMOND
DEPARTMENT OF CITY PLANNING
THE CITY OF NEW YORK
 AUGUST 1936



NEW YORK EXHIBIT 1



NEW YORK EXHIBIT 2

I would like to make a statement on behalf of Dr. H. G. Wilm, Conservation Commissioner and Chairman of the Water Resources Commission.

Consistent with the enunciated philosophy of water resources of New York State, and the policy of the Water Resources Commission, the statement made by Dr. Hollis Ingraham, our State Commissioner of Health, represents also our views.

The Conservation Department, through the Water Resources Commission, participated in and endorses these views. Our Conservation Department, of course, is concerned and vitally interested in the development of all of our natural resources and the marshaling of the forces which can bring this about. Actually, the resources of the waters around New York and their associated aquatic resources, plus the recreational values, indeed are important. We are convinced that a healthy situation of progress exists. We are further convinced that there are mechanisms, both State and interstate in character, which are capable of bringing about the accomplishment of the goals which the people desire in the form of better and cleaner waters.

So we heartily endorse Dr. Ingraham's statement. That is all I have to offer at this time.

MR. STEIN: Thank you, Mr. Montanari.

DR. INGRAHAM: I believe this concludes the formal statements.

MR. STEIN: Thank you, sir. Are there any comments or questions? Dr. Colosi?

DR. COLOSI: I have no questions.

MR. STEIN: Do you want to make a statement for the Interstate Sanitation Commission?

DR. COLOSI: Yes, Mr. Chairman.

STATEMENT OF DR. NATALE COLOSI
CHAIRMAN, INTERSTATE SANITATION COMMISSION

DR. COLOSI: The Interstate Sanitation Commission and the State and local water pollution control agencies of New York and New Jersey were engaged in active and effective programs prior to the calling of this conference on the waters of Raritan Bay and tributaries thereof. In the time since the first session of the conference these agencies have continued the pursuance of their programs vigorously. It is the purpose of this statement to present a report of the work of the Interstate Sanitation Commission relative to the waters concerned. In so doing, it will be necessary to make some reference to the program of the other conferees. On the whole, however, it seems more appropriate for the statements submitted on behalf of the States of New Jersey and New York to deal with their respective activities and for the Commission to concentrate on a presentation of its own work.

The Commission's statement for the first session of this conference reported on the activities which had been conducted at an intensive level since 1957 in the Arthur Kill area. This work has continued with the Interstate Sanitation Commission cooperating closely with local and State Departments of Health, municipalities and industries. Joint investigations and sampling of the discharges from the municipalities and industries have been a part of this program. This pollution has resulted in a dissolved oxygen problem within the Arthur Kill which has been of concern to this Commission as well as the State Health Departments for some time. Efforts of these agencies to rectify the situation have been underway for years but no method was known for determining the assimilative capacity of the waterway so that treatment requirements could be set to meet the standards of this Commission. However, in November 1962 such treatment requirements on the Arthur Kill were made possible by a new procedure developed by the Commission staff for determining the assimilative capacity of a tidal waterway. A report on the treatment requirements in the Arthur Kill was issued by the Commission which directly affected twenty-four industries and six municipal plants discharging wastes directly into the Arthur Kill. These municipalities have already expended large sums of money to provide primary treatment for their wastes which consist of large quantities of industrial wastes as well as domestic sewage. Our plant investigations indicate that these plants have consistently provided effective primary treatment. These requirements specify full secondary treatment for all municipal plants, and similar treatment for industrial wastes which contain biochemical oxygen demand. All other industrial wastes would have to receive any treatment necessary to meet the other standards of the Interstate Sanitation Commission. The complete report on Treatment Requirements in the Arthur Kill may be found on pages 17-40 of the 1962 Annual Report of this Commission. The New Jersey State Department of Health has issued orders against five municipal plants and three industries which account for over 95 percent of the wastes having an effect on the dissolved oxygen in the waterway. The New York City Department of Health has issued orders against two industries and a hospital on the New York State side of this waterway, requiring the degree of treatment set by this Commission. This program of abatement will not only improve the waters of the Arthur Kill, but also will improve the quality of adjacent waters.

The United States Army Corps of Engineers conducted a study on their hydraulic model which they constructed to scale, of the waterways of this metropolitan area. The study was co-sponsored by the New York State Water Pollution Control Board, New Jersey State Department of Health, New York City Department of Health, and this Commission, with the latter acting as coordinator. The report on this study was received recently. Data received on dye releases made at points which would have an effect on the Raritan Bay are now being analyzed by this Commission's staff. The Model Study has already confirmed some of the previous water area studies made by the Commission and should provide important information on the movement of the pollution in the waterways of this area.

The Commission has been sponsoring two studies at Rutgers University. Since there is a large concentration of industry in the Arthur Kill area, these studies were made to determine the possible effects of industrial pollution on fish life. Although only the first of these studies has been completed, there is evidence that industrial wastes do affect fish of this area. The action taken on the Arthur Kill is expected to remove these materials. These studies on pollutional effects on fish will be continued.

The Commission has installed a continuous monitoring system which is located on the Arthur Kill near the Rahway River. Water quality data will be telemetered continuously to a recorder located in the Commission office. It will not only provide information on the condition of the waterway at any time of the day and night, but will alert the staff if illegal discharges are made. This should be of great benefit in controlling and improving the quality of these waters. In 1957 the Interstate Sanitation Commission took a Consent Order against New York City. This Order provides a specific time schedule for the construction of treatment facilities and the abatement of pollution. The recently expanded and reconstructed plants at Hunts Point and Coney Island were projects required by this Consent Order. During the past year New York City committed more than \$80,000,000 towards the construction of new sewerage facilities. A large portion of this was the final installment on Newtown Creek Pollution Control Project (total cost \$159,543,000) which will remove approximately 300,000,000 gallons a day of raw sewage and improve the waters passing through the Narrows and into the bay area. The schedule also calls for construction projects during the next several years at Port Richmond, Red Hook Section of Brooklyn, and North River, which will further improve the waters discharged through the Narrows. The Consent Order also contains provisions for the interception and treatment of sewage discharged from the Tottenville area of Staten Island.

Pursuant to an administrative order by the State of New Jersey, the plant at Keyport was required to make extensive improvements which were already under construction at the time of the first session of this conference. The work at Keyport was completed in 1962. Atlantic Highlands, Highlands and Keansburg were notified during 1962 that they were not meeting the standards of this Commission. Atlantic Highlands and Keansburg have each engaged consulting engineers to make studies of their treatment facilities. It was pointed out at the first session that the Middlesex County Sewerage Authority completed trunk sewers, pumping stations and treatment plants at a cost of over \$31,000,000 in

1958. This plant treats over 43,000,000 gallons per day of wastes. This has brought about a remarkable improvement in the Raritan River. The New Jersey Health Department and the Authority have a continuing program of further abatement of pollution on the Raritan River beyond the limits of our District.

From information obtained through studies by other agencies during 1962, it was found that there is a dissolved oxygen problem in the Raritan Bay area during some periods of the year. There is an indication that there may be other factors affecting the dissolved oxygen besides the biochemical oxygen demand of the treatment plant discharges. One of the factors is believed to be algae growing in the waters. The Commission has already started a study to further determine the cause of this dissolved oxygen problem. If the dissolved oxygen problem is found to be caused by discharges of biochemical oxygen demand from treatment plants, all necessary steps can and will be taken to correct this condition.

Examination of pollution sources in the Raritan Bay area reveals that the following items contribute matter which affects water quality adversely:

- 1) Effluent from several municipal treatment plants whose discharges do not meet the standards of the Interstate Sanitation Commission;
- 2) Discharges of raw sewage from New York City;
- 3) Discharges along the Arthur Kill;
- 4) Pollution attributable to various forms of marine life.

The programs of the Interstate Sanitation Commission, and of the States of New York and New Jersey, are dealing actively and forcefully with the first three of these items and to some extent with the fourth. The activities are as follows:

- 1) The several improperly functioning plants have been detected and in each case notified to take any steps necessary to correct the condition.
- 2) Enforcement action against improper discharges from New York City has been taken by the Interstate Sanitation Commission. The current second phase of this program is in the form of a Consent Order of the Commission against New York City taken in 1957 and prescribing a time schedule on new construction, plant expansion, and cessation of below standard discharges. The Consent Order deals not only with discharges in Raritan Bay and vicinity, but those from all New York City locations as well. Actual construction under the Consent Order is now passing the halfway point. The completion of work under the Consent Order will stop the discharge of all raw sewage.
- 3) Discharge of wastes into the Arthur Kill has posed a most vexing problem as previously described in this statement. The programs of the local, State and interstate agencies are dealing energetically with this

problem.

4) At the present time, pollution from the activity of marine life indigenous to Raritan Bay is not subject to abatement by administrative or judicial process. Research to determine the effects of such marine life on water quality and the method for its control would be useful. Some of it is being done by the Interstate Sanitation Commission, and undoubtedly could be done by other agencies as well.

The information developed by the conferees makes it clear that the State, interstate and local authorities have had an active and effective set of programs for pollution control and abatement in the waters forming the subject of this conference for a number of years and that such programs are continued. Taken together they provide the means for dealing with all the waste discharges affecting the water in question. Consequently there is no reason for the continuation of the conference, except to the extent that such continuance may be desirable as a means of authorizing the completion of certain research studies undertaken by the Public Health Service pursuant to the agreed recommendations of the first session of the conference.

The Federal Water Pollution Control Act (33 U. S. C. Sec. 466 et seq.) establishes the Government policy to be that:

"In connection with the exercise of jurisdiction over the waterways of the Nation and in consequence of the benefits resulting to the public health and welfare by the prevention and control of water pollution, it is hereby declared to be the policy of Congress to recognize, preserve, and protect the primary responsibilities and rights of the States in preventing and controlling water pollution.."

At the first session of this conference, Chairman Murray Stein said:

"We close these things out, and we don't expect to stay here forever, but certainly at this point it is our job, and I think that these people who have watched this throughout the country have recognized that our job is to turn this over to the state and local authorities and the interstate agencies and get out of this as fast as possible. One of our hard jobs, and something you at this stage might not realize, is terminating the case and getting out. This is something that sometimes is difficult to do." (Transcript, p. 116).

The activities of the State and interstate pollution control agencies as detailed by them at the first session of this conference and during the current session have been and continue to be matters of public record. If the Public Health Service had not become familiar with them prior to the decision of the Surgeon General to call the conference, the year and one half of the study has certainly afforded the Public Health Service and the Secretary of Health, Education and Welfare full opportunity to become conversant with these programs. It should not be difficult to terminate this proceeding and permit the States and the interstate agency to continue to exercise "the primary

responsibility and rights" that it is the declared intent of Congress to preserve.

To this end, we propose the following as the agreement to which the conferees should come:

1) The States of New Jersey and New York and the Interstate Sanitation Commission have active and effective programs for the control and abatement of pollution in the waters which have formed the subject of the conference.

2) There is no use for a continuation of the conference, and said conference is hereby terminated.

3) The undertaking and continuation of basic and applied research into scientific and technical problems of pollution control and abatement is essential to the promotion of more satisfactory water quality programs in the waters which have formed the subject of this conference as well as elsewhere. Consequently, the Secretary of Health, Education, and Welfare, acting under the research provisions of the Federal Water Pollution Control Act (33 U. S. C. Sec. 466c) and the other conferees should be encouraged to engage in research activities designed to secure information and improve techniques useful in the further control and abatement of pollution in such waters.

Thank you very much.

MR. STEIN: Thank you, Dr. Colosi. Are there any comments or questions?

We will try to recess for lunch at about twelve o'clock and reconvene at one-thirty, but, in order to conserve as much time as we can, I would like to ask, have any of the conferees had any other invitees that they think they can put on now?

MR. ANDERSON: Mr. Chairman, we have Mrs. Wallace from the Oyster Institute here. She has a statement she would like to present and I would like to call on her at this time. Mrs. Wallace.

STATEMENT OF ELIZABETH M. WALLACE, DIRECTOR
OF THE OYSTER INSTITUTE OF NORTH AMERICA

MRS. WALLACE: I am Elizabeth M. Wallace, Director of the Oyster Institute of North America, and, as such, represent the shellfish industries of our country. Our organization represents the growers and dealers of shellfish of the United States. Some of our members handled clams from Raritan Bay prior to closure of the bay by the States of New York and New Jersey.

We applaud your efforts. We urge you to continue. Your efforts determine our existence, because our product is sold only because of public confidence. We hope that your efforts are so successful that Raritan Bay will become a model for similar problems existing all over this country.

Raritan Bay is the source of a valuable resource of clams. We estimate that the value at present is around \$40 million, with an annual crop of about \$2-½ million to the industry. This is a minor factor in your consideration, to be sure, but this resource does exist.

The potential economic importance of this area in clams alone should be realized.

We seem to be an index by which you can judge how you are doing, because an incident seems to have precipitated these various meetings. Two of the industry members are with us today. They are the flesh and blood of what we are dealing with. They are Mr. Parsons, John Parsons, and Mr. Stanley Cottrell, who are sitting over here, who are clam dealers and processors in the State of New Jersey.

These resources should be available. At one time there was a thriving oyster business which the encroaching pollution eliminated. The potential is tremendous for our industry. We hope to be able to take advantage of it.

It is our position that a program of pollution abatement in this area should have as its goal the achievement of a standard of water quality sufficiently high to permit the direct harvesting and marketing of these shellfish. As long as these resources cannot be used they are as a pistol to the heads of our whole industry, because should these shellfish be taken and get to the markets, it destroys the industry all over our country.

We urge the participating agencies to establish as their goal in this pollution abatement program the criterion of the achievement of a standard of water quality sufficiently high to permit the direct harvesting and marketing of these shellfish. Rapid realization of this goal will improve the economy of both New York and New Jersey by the utilization of these clam resources, which can be considered as an economic loss under the present conditions. Moreover, as I said before, they represent an ever-present threat to the shellfisheries of the entire country, with the possibility of these clams illegally entering the market.

Our industry hopefully looks to you to effectuate a program in Raritan Bay that would serve as a model for pollution abatement in similar areas throughout the nation.

Again let me say we deeply appreciate the privilege of appearing before you. We wish you well and hope this will serve as a model to other great tributary systems that have similar problems.

MR. STEIN: Thank you, Mrs. Wallace. Are there any comments or questions?

MR. CALLISON: Mr. Chairman, I wonder if I might have the privilege of presenting a very brief statement, because I am not certain I can return after lunch?

MR. STEIN: Would you identify yourself, sir?

STATEMENT OF CHARLES CALLISON, ASSISTANT TO THE PRESIDENT,
NATIONAL AUDUBON SOCIETY, MEMBER OF THE PRESIDENT'S
WATER POLLUTION CONTROL ADVISORY BOARD

MR. CALLISON: My name is Charles Callison and I am Assistant to the President of the National Audubon Society. I did not come here intending to make a statement. No one invited me to appear today. You, Mr. Stein, informed me that this conference was going to be held, the day before yesterday. I came as an observer, but I am strongly moved now to make a statement.

MR. STEIN: May I identify you a bit further? Mr. Callison is also a member of the President's Water Pollution Control Advisory Board, and, as such, he is an overseer of the general Federal program.

Mr. Callison.

MR. CALLISON: Thank you. I do not pretend to consider myself an overseer of the Federal program, but I am one who is deeply interested in it.

It seems to me there has been a rather remarkable acceleration of effort since the first conference on the Raritan Bay problem was held some twenty-one months ago. It is my impression as an interested citizen observer that the intervention of the Public Health Service has been a stimulus or a help in this effort, and perhaps both. It is also my strong belief, based on reports of the polluted condition of the waters of Raritan Bay that have appeared in the press, and which have been reported here and elsewhere, that the problem is such a colossal one that only a small beginning, at best, has been made in actual abatement. I question that anyone here really knows or is in a position yet to know if there has been any measurable improvement in the heavily polluted parts of Raritan Bay.

The United States Public Health Service cannot escape its responsibility in this area, despite the invitation heard today for them to get out. In my opinion the State and interstate agencies should welcome the help of the Federal Government. It would be a serious mistake in the public interest for the Public Health Service to withdraw at this time.

It came as a little bit of, not a little shock, but a tremendous shock, to me to hear the defensive and negative statements that were presented by the New Jersey and New York Authorities today.

Thank you.

(Applause.)

MR. STEIN: Thank you, Mr. Callison. Are there any comments or questions?

DR. KANDLE: I would like to make one point, and I would like to stress this particularly: That most of the money that is going into the control of pollution is going into it from local dollars, and industrial dollars, and State dollars, and very little Federal dollars. The Federal Government is not

abating the pollution of these waters. It is the local and State agencies and the local industries that are doing it.

MR. CALLISON: I wonder if the action that has resulted mostly in investigations -- and I was interested in the emphasis on the words "intensive" and "comprehensive" every time the word "studies" or the word "investigations" was used this morning -- I wonder perhaps if these have not actually been accelerated not by the great amount of money put into this effort by the Federal Government, but by its presence and by its enforcement authority which is in the background, and which I think is extremely important in this area of interstate waters.

MR. STEIN: Thank you.

DR. KANDLE: I would just make one comment: One cannot quarrel about adjectives like acceleration, because it can be a little or a lot.

MR. CALLISON: No, you cannot. My point was that your statement was replete with emphasis on intensification of studies and investigations, but we have yet to see the results of abatement action in this area.

DR. KANDLE: I do not agree with you.

MR. STEIN: Are there any further comments or questions again?

(No response.)

MR. STEIN: If not, we will recess to one-thirty.

(Whereupon, at 12:05 o'clock p.m., the conference was recessed until 1:30 o'clock p.m. of the same day.)

AFTERNOON SESSION

MR. STEIN: May we reconvene?

I think unless the conferees have any more people to call on, or want to amplify their statements any more, we are probably ready for a discussion. I also think that the issue has been fairly accurately and completely presented this morning.

I think the elements of the facts in this situation, in the Federal-State-interstate relationships, are relatively clear. We did have a conference under the Federal Water Pollution Control Act in August of 1961. Secondly, I think it is pretty generally agreed that the States and the interstate agencies, under their programs, have been making considerable progress.

I think the third issue here, and possibly the vital issue for discussion, is what the role of the Federal Government is in this matter, and particularly the Department of Health, Education, and Welfare, through the Public Health

Service's survey.

I am not sure in listening to the presentation of all concerned that we have an entirely consistent viewpoint of both States and the interstate agency. I think all their statements are relatively clear.

One, I think the Federal position is a relatively simple one. At the conference in August of 1961 all parties agreed that there was to be a survey and investigation of the river. The survey program was outlined in general terms, but with considerable particularity by the conferees at the first session of the conference. As I understand it, the Project Director, Mr. DeFalco, has attempted to carry out these directives. In accordance with these suggestions, we have provided an annual budget for this project until completion, and we intend to give this as high a priority as we have to, or as we had intended to, a budget of about \$200,000 a year.

We have a resident scientific investigation group investigating Raritan Bay as a result of that first conference. I might point out that in many cases we have a sort of transient group coming out from our Cincinnati laboratories to do the relatively short-term study. This group then reports and goes home.

Because of the complex nature of this problem which everyone recognized, in August of 1962 we set up a resident investigation group with a Project Director, Paul DeFalco, with headquarters at the Raritan Arsenal, and a relatively large laboratory has been set up. We have three boats with twenty-five people. We, or the Public Health Service people, have proceeded in good faith with this study. The study, according to the agreed position unanimously taken in August of 1961, was to gather "scientific data, taking into account a wide range of factors and technological problems, including health, conservation, water policy and uses, and industrial processes."

In setting up this project, Mr. DeFalco and the States and interstate agencies and others concerned set up a technical committee.

As I understand it, it was further agreed that this project would have a time schedule of about two years. About one year has elapsed.

As I further understand it, the Project Director has indicated to us that he feels he has to have another year to go -- he is in midstream and at mid-point -- in order to get the technical answers which would enable us in the Federal Government to make a determination of what our posture would be in the Raritan Bay case.

In the absence of our technical advisers' statements as to the adequacy of the information, I do not know that we would be in a position to make any recommendations to the Surgeon General or to the Secretary concerning this case in a definitive manner.

I think we have proceeded in good faith and we owe it to ourselves, the States, the interstate agencies, and, most importantly, to the people and the

residents of this area, to proceed in good faith with an agreement that we have made.

On the basis of this agreement made in August 1961, we have made representations to the Executive Department through the budget process, and to the Congress, for funds to pursue this study. These funds have been forthcoming. Again we are at the halfway point. I think we are under an obligation, or our people indicate they are under an obligation, to complete this.

Now, as far as I understand it, the New York group thinks that the study is about completed. They feel we should conclude the conference and revert perhaps to certain bacteriological studies on a limited basis.

The New Jersey group and the Interstate Sanitation Commission believe we should confine ourselves to research.

I think in this field particularly, all three agencies concerned are relatively sophisticated. The proceedings we are dealing under here and the portion of the Federal budget we are proceeding under here is an enforcement budget. We have another section of the Act dealing with research. There are two methods by which research funds are available. One is for someone to make an application for a grant or a contract for research. The other is for us to go into direct research ourselves. As far as I know, there has not been an application for a grant or a contract for research in this area, but the criteria and the system for doing that are very, very clear.

An application is made and must come before a study committee, and then the Surgeon General's National Advisory Health Committee, for review. If this research project stands up, it will get a grant. That avenue is always open.

The other problem is whether we are going to do direct research. Again, research budgets are dealt with very, very carefully before the Congress. The budget, as you know, for this coming fiscal year, starting on July 1, has been submitted to the Congress. The budget in no way, manner or means provides for Federal research for the Raritan Bay project as proposed here, and, as far as I know, it has never been proposed, and I do not know whether it would survive the searching budget process if it were proposed in competition with the other projects. However, if we were to assume direct Federal research, obviously unless the Congress would vote some money which was not asked for, all the funds for direct Federal research are spoken for, and, as far as I know, there is no application in for a grant.

I think these are the positions we have. I think the position of the Federal technical staff is that they have to complete the study which they started with complete acquiescence of the States and interstate agencies in good faith before they can come up with the technical answers. We recognize that there are other views here.

Our function here is twofold: First it is to summarize what we come up with here. I would hope we can come up with a unanimous agreement whereby we can go back to the Secretary and suggest a summary to him. If we do not come

up with this unanimous agreement, then I think we can just present the divergent points of view presented here, and, of course, the Secretary will make the decision.

Dr. Ingraham in a large sense was right in his statement when he points out that the Secretary has to make the determination when the conference is concluded. As I see it, this conference is recessed; it is not concluded. I don't know from the point of view of the Federal technical people whether they feel they have enough information. It seems clear to me from what they indicated to us that they do not feel they have enough technical information right now to make technical recommendations which will conclude the conference. However, if this is the conclusion or the considered judgment of some of the conferees, we will certainly present these views to the Secretary.

It would seem to me from a personal point of view that we had arrived at an agreement in August 1961. I think the cause of pollution control would be best served and the cause of the Federal-State and interstate relations would be best served, if we would adhere to our original agreement entered into, I hope, in good faith, by all parties concerned, and follow that agreement to its logical conclusion, and let our technical people come up with a definitive report.

Are there any comments or questions?

DR. WENDELL: Mr. Chairman.

DR. COLOSI: Dr. Wendell of the Interstate Sanitation Commission.

MR. STEIN: Yes.

DR. WENDELL: Mr. Chairman, I think that while there were some differences, naturally, in the presentations among the conferees, that basically they do represent a very wide area of agreement, and I am wondering whether those things that appear to be dissimilar in them are really basically dissimilar.

From the point of view of the Public Health Service, it seems as though many of the questions with respect to the adequacy of the State programs, which may have been in the Surgeon General's mind at the time a year and a half ago, have in that year and a half been afforded the opportunity to be resolved in the sense that you have had people looking at the Raritan Bay area and a study is underway now since the last session of this conference. So it would seem to me as though the Public Health Service would now be in a position to say very much more definite things about the substance and the nature of the State and interstate programs for pollution control and abatement which exist, and which have existed, prior to the calling of the first session of the conference; and also with respect to those steps which have been taken since August of 1961.

It seems to me as though on the State and the interstate side all of the presentations here indicate elements of those programs. Certainly each of the conferees on the State and interstate side has presented a program which has been characterized by all concerned as being, in the words of our own statement,

for instance, active and effective. We don't think there is much doubt on that particular score.

Obviously, each conferee paid most attention to those elements of the combined sets of programs which were being carried on by the particular agency or government that was making the particular statement at the time. So such differences as exist in that respect are, rather, differences in the area of coverage of the individual reports, rather than differences in the sense of any disagreement.

I think also that while the language may have been quite a bit different from statement to statement as among the conferees with respect to the need for continued investigatory research in the Raritan Bay area, that all of the statements in one way or another, including those of the Public Health Service, the State of New Jersey, the State of New York, and the Interstate Sanitation Commission, recognize that we do not have all of the answers as to how best from the scientific point of view to control and abate pollution; and that undoubtedly, if studies are permitted to continue, such information will become increasingly available, undoubtedly, not only for the projected period of any particular study, but into the future, as new technological processes and new scientific discoveries become apparent.

So it would seem to us in the Interstate Sanitation Commission that if these statements mean what they appear to mean, and, Mr. Chairman, if your words in opening this afternoon's session in terms of your recognition of the effectiveness of the State and interstate programs represent the actual position of the Public Health Service as well, there are a very substantial number of things that we can say.

I think we can recognize the factual situation which has persisted with respect to pollution control and abatement on the Raritan Bay, and perhaps we can do that in some detail.

We can also recognize, I think, that it is appropriate to continue to study the situation along the lines recommended by the conferees back in August of 1961. It seems to me as though that would be a substantial and reasonably complete set of agreements with respect to the proceedings that have occurred here today. If there should be any other views, aside from the areas in which I have indicated, it may very well be that there would be considerably more in the way of difficulty in coming to any agreement, if indeed any agreement could be had, on matters outside of these two. But basically I do not see any reason why any additional matters but these two I have indicated are really within the purview of the work that has been done both at the first and second sessions of the conferences.

MR. STEIN: I think, as you pointed out, maybe the two States and the Interstate Agency are very much in agreement, but I don't think we have a substantial disagreement with the States and the Interstate Agency. I think we are all pretty much in agreement. I think if, as I understand Dr. Wendell, the conferees could subscribe to what he just said -- and we would have to ask all the conferees -- if the conferees could subscribe to that I think we might be in the

position of trying our hand at an oral summary to see if all people would agree with it, if we are agreed with what Dr. Wendell has said not only in principle, but I think in words. I think he has stated it very well.

Is this agreeable to the conferees, or do you have any disagreement with Dr. Wendell's position?

DR. INGRAHAM: Would he just summarize it briefly again?

MR. STEIN: I think what Dr. Wendell has put down are two specific points. One, we would outline with considerable particularity the real strides that both States and the Interstate Agency have made. Two, we would indicate that in accordance with the directives of the conferees in August of 1961, that the study that the Public Health Service is doing be completed.

If I have misstated that, Dr. Wendell, please correct me.

DR. WENDELL: No, I think that is basically it -- with respect to the continuance of the present study, of course, to its conclusion, as projected, which is now indicated to be perhaps a year or so off; and in the terms that were agreed to back in August of 1961.

MR. STEIN: That is correct. Is that agreeable? Do you want me to try it and let's see what happens?

DR. KANDLE: Could I make one point, Mr. Chairman?

MR. STEIN: Yes.

DR. KANDLE: I am not in disagreement, and I surely do not want to introduce detail into this, but I think there is one point that we might try to clarify now, that is, it seems to me, there are three goals of the study. One, as I have heard Paul DeFalco point out, and correctly, that it started off along the general lines we agreed to in 1961. It does not seem to me that is an irrevocable thing. As time passes, and we do the work, we understand we might want to make some changes.

MR. STEIN: That is correct.

DR. KANDLE: You just stated a point which I had not thought of in such clarity before, Murray, and that is you said you thought that two years were needed to enable us in the Federal Government -- and I am trying to quote what you said --

MR. STEIN: Yes.

DR. KANDLE: -- to make recommendations to the Surgeon General and the Secretary in a definitive manner. That would be a somewhat more narrow set of goals for the study, if I understand it correctly.

MR. STEIN: No, I am sorry. Let me clarify this, I hope.

Dr. Ingraham raised this point, very properly, that the Secretary has to come to a conclusion at some time when the conference is going to conclude. By the way, that remark I made that we have difficulty in terminating this is not because we do not want to terminate it, but in some other instances -- not this one -- the States don't want us to leave. They want us to keep surveying.

Now, the point I made is not in relation to the broad aspects of the survey, Dr. Kandle, but in relationship to our statutory duty, where we have to make a recommendation to the Secretary in order eventually to get him to terminate action in the case. Whatever interstate or State agency you are in -- and both of you are in the position of administrators therein -- you have to ask the same question that the Secretary or the Surgeon General would ask: Will the technical people sign off on this? Obviously, he is going to ask some very, very serious questions if they are not.

The sole point I made is, our technical people tell us they have designed this study with a two-year time schedule from the beginning. The States and the Interstate Agency were aware of this -- that they would be in a position to sign off when this was completed. This is not necessarily the scope or the major impact of the study. This will just be to satisfy the bureaucratic statutory obligation when we go up to the Secretary to tell him that the technical people were satisfied. I don't think we can get any definitive recommendation or action by the Secretary without that, just as you probably would not do in your own Departments.

DR. KANDLE: Just for clarity's sake, hopefully let me reiterate what to me seemed to be three parameters of the survey, the laboratory, and the field work. One was the point it started, which had in it some of the recommendations of the conferees and the goals of the Public Health Service. I see your point, I think, with regard to the data necessary for the Secretary, but it does seem to me that a large parameter of the continuing study is to gather data for the use of the Secretary.

We in our statements, I think -- and I think this is a point on which we are quite close together -- suggest that there are clear research problems. Perhaps the word "research" is throwing us, but I didn't mean it in terms of Federal bureaucracy, but rather in terms of goals.

MR. STEIN: Yes.

DR. KANDLE: Because if the goal is to seek new information which is clearly related to abatement, that is one thing; or if it is descriptive with regard to the degree of pollution, or whatever, that is another goal. Those are the three parameters.

MR. STEIN: I would thoroughly agree with you, Dr. Kandle. As a matter of fact, I think if you have seen and watched pollution cases in the country, you would note the Federal Government and the States and interstate agencies are very close together here.

As far as I can determine, there is really no disagreement at all, even if you want to quibble, on scientific facts of what we have found. In essence, I think this is the key to a pollution case, because you are dealing with the measurement of physical facts and physical phenomena. You are reasonable people. We have scientific people, and the Interstate Agency and the States have just as competent scientific people. I do not think that reasonable men can disagree on this, and this has been evident here.

The second point is, I think the States and Interstate Agency have evidenced a very active interest in abating pollution. This is not an attitude where there is any difference, I believe, in philosophy, or movement, or anything of that sort. I think both States and the Interstate Agency have indicated that where there is pollution interfering with what they would consider a legitimate use of these waters, they will move to abate it. I think we have had plenty of statements here which will indicate that. So I really do think we are very, very close together on this, and there are no disagreements.

Let me try something and see if we more or less can agree on these two major points.

The first point will be rather detailed because I think Dr. Wendell is right, that is, we should give due credit, and in detail, to the accomplishments of the States and the Interstate Agency.

We might start and say that the conferees agree to the following conclusions and recommendations:

The States of New Jersey and New York and the Interstate Sanitation Commission have active and effective programs for the control and abatement of pollution of the waters of Raritan Bay and adjacent waters, as evidenced by:

With respect to waters other than those originating in Arthur Kill and coming through the Narrows, the New Jersey communities have been steadily improving treatment since the 1940's.

At the present time, all domestic wastes from New Jersey discharging into the Hudson River and upper New York Bay area have been intercepted for treatment except for a portion of Weehawken and Union City, where the construction of needed facilities is nearing completion.

On the New York side, New York City, pursuant to a Consent Order of the Interstate Sanitation Commission dating from August 1957, has been engaged in a large program of construction. The Hunts Point and Coney Island projects have been completed and under construction are pollution control projects at Newtown Creek and Jamaica Bay. Scheduled for early construction pursuant to the Consent Order are projects at Red Hook, Port Richmond, North River and Ward's Island. On these projects, as well as those mentioned subsequently, the work is done pursuant to the approval of plans and specifications by the New Jersey and New York State Health Departments.

I might add here parenthetically that even with the Federal construction

grant program all the work is done pursuant to the plans of the State Health Departments in this area. This is very properly what should be a job for the States.

Two, entrant waters from the Raritan River were improved by completion in 1958 of the Middlesex County Sewerage Authority Treatment Plant. The New Jersey Health Department and the Authority have a continuing program on further abatement of pollution of the Raritan River.

Three, in the Arthur Kill intensive research and investigations by the two States and the Interstate Sanitation Commission have been underway since 1957. As a result of this effort, information has recently become available which has formed the basis for the issuance of eight orders by the State of New Jersey, as follows:

1. Elizabeth Joint Meeting;
2. Rahway Valley Sewerage Authority;
3. Linden-Roselle Sewerage Authority;
4. Borough of Carteret;
5. Woodbridge Township;
6. Humble Oil and Refining Company;
7. American Cyanamid;
8. General Aniline and Film Company.

Also, three by New York Authorities as follows:

1. Procter and Gamble;
2. Nassau Smelting and Refining Company; and
3. The Willowbrook State School.

Four, in Raritan Bay, pursuant to an administrative order and a time-table agreement with the Attorney General of the State of New Jersey, construction of needed works at Keyport was already underway prior to the first session of this conference, and was completed in 1962.

At Atlantic Highlands, Highlands, Keansburg, Union Beach and Borough of Matawan, and two industrial installations, steps of an engineering or legal nature are in progress.

The Borough of Highlands is installing an automatic chlorine residual analyzer and recorder together with an alarm system and is also planning to repair the outfall line which would take the effluent from Raritan Bay and

discharge it into the Atlantic Ocean.

The Borough of Atlantic Highlands has hired an engineer to prepare preliminary studies to enlarge the present facilities by 50 percent and has also applied for Housing and Home Finance Agency planning funds. In addition, the borough is planning to install a chlorine residual analyzer and recorder with an alarm system.

The Borough of Keansburg has plans for additions and alterations to the existing plant, and they have been approved by the State Department of Health. The borough plans to advertise for bids soon.

In Union Beach a certificate of necessity has been issued to allow this community to exceed its bonded indebtedness limitations. Preliminary plans have been approved by the State Health Department for a sewage system and treatment plant.

The Borough of Matawan has completed construction of a new plant which was placed in operation during the last week of April 1963.

Construction of a new treatment plant by the Madison Township Sewerage Authority is nearing completion, with a scheduled completion date in May 1963.

Plans for proposed expansion to increase the capacity of the Middlesex Sewerage Authority plant are scheduled to be completed by the latter part of 1963.

The International Flavor and Fragrances Company hired an industrial waste engineer to develop treatment facilities. A feasibility report has been furnished.

The pollution sources of the B. Zura Chemical Company have been eliminated by the closing of the plant.

For the New York waters concerned, the State Department of Health has completed classification studies and reports covering the subject waters. Arrangements are now being made for public classification hearings to be held in New York City during the months of June or July of this year. Actual classification of these waters will be made by the Water Resources Commission of New York State. The classifications of the Interstate Sanitation Commission have been in force for over twenty years.

Now, to get to the second portion or Roman Numeral II.

The Public Health Service, in collaboration with the New Jersey State Department of Health, the New York State Department of Health, and the Interstate Sanitation Commission, will continue and complete the investigation and study of the Raritan Bay and adjacent waters in accordance with the recommendations of the conferees at the first session of the conference held on August 22, 1961.

That concludes the summary.

Are there any comments, questions or statements?

MR. MARSHALL: Yes.

MR. STEIN: Pardon me. I do not think we can permit, under the rules of the conference, people to come forward or speak from the floor now. If you wish to speak and the States or the Interstate Agency as an invitee have asked you to speak, we would be happy to have you speak. At the conclusion of this, of course, if there is no objection from the conferees, I have no objection to anyone from the floor making a statement.

Are there any objections, or comments, or questions, on this? If not, I think we can conclude, unless we hear something before the conclusion of this, giving the conferees an opportunity to change their minds, that this is about where we stand. I do think that we have made and there has been considerable progress in this area. I would like to emphasize this.

I thoroughly agree with Dr. Kandle that there is good progress, in essence, and the progress is due to the activities of the State and local authorities. They are the ones who put up the money and they are the ones who moved ahead, and I think we are working ahead to progress on this. I do think that all of this work in this report can only benefit all concerned.

Is there anyone in the audience who would care to say anything and make a remark now?

Yes sir. I will ask those who want to make their remarks, if they can, to confine them to about five minutes, because some of the conferees have to get an airplane out of here very, very shortly.

STATEMENT OF JACK MARSHALL
EKROTH LABORATORIES, BROOKLYN, NEW YORK

MR. MARSHALL: Jack Marshall, Ekroth Laboratories, Brooklyn, New York.

I would like to give a little different view from what has been given here today. It is in line with what Mr. Callison said this morning.

A lot of the work that the Interstate Sanitation Commission and the State of New York and New Jersey mentioned, that were offered here, has been done fifty years ago, and I believe there are a lot of misstatements in the Interstate Sanitation Commission's reports and the new reports. I would not have time to give it in five minutes. However, I will challenge both States and the Interstate Sanitation Commission, if they give me one half a day, surely a day, I will take them out and show them a half a billion gallons of legal effluent that is building up at 20,000 most probable number in the Narrows. These are plants that are run by New York City. And Mr. Pinel wants to tell us what to do that Dr. Roper said could not be done fifty years ago. The Coast Guard and the Geodetic Survey will carry out this statement.

I do say that when this investigation stopped at the Arthur Kill it was

not doing enough. New York State and New Jersey both should have gone up the Hackensack and the Passaic Rivers. There is at least 40 million gallons a day that is coming down into Staten Island and is being dumped in that little corner there, which the books that we have here indicate will not get out fast. The Coast Guard and the Coast and Geodetic Survey, which is the Bible of all the engineers of New York City, will show that the tides cannot take that out.

So we are getting in a half a billion gallons of sewerage effluent that will not comply with New York State as to what effluent should be. They are way up in the most probable numbers. Therefore, any time any of these agencies, I will challenge them, want to spend a day, I will go with them in a car or boat and show them 40 million gallons a day from each waterway, either at Jamaica Bay, or up the East River, or down Staten Island, where this is going on.

I say now, Mr. Stein, Mr. Chairman, that the Federal Government should go further than they are now. It should not simply agree with these agencies, but you have to police them.

MR. STEIN: Thank you, Mr. Marshall.

Let me say one thing. We would appreciate, and we have an open mind on this, any information you want to give our technical people. We will be glad to receive it.

MR. MARSHALL: It is too secretive.

MR. STEIN: It is not too secretive. The information is given here and I think the record speaks for itself.

MR. MARSHALL: Did you know about the secret meeting yesterday afternoon of New York State and New York City? Nobody can listen in on those things.

MR. STEIN: Mr. Marshall, I think it is anyone's privilege to have a secret meeting. You might do that with your wife sometimes. I don't know. I think in respect to this, we should, or the Chair should, set the record straight. There may be some differences as to the scope of this study, or what we are doing. I have been in the Federal Service on this business for over twenty years, and as far as I know, there is no implication that the facts, the figures, or the material we are getting from New York, New Jersey, and the Interstate Commission are not complete and accurate in every respect and are not completely adhered to by our scientific and technical personnel. I don't think there is a shade of difference in the analysis of the material. Now, there may be some gaps in the material, or decisions of where we should go, but I think, as you can tell just by listening to this proceeding and reading the record here, I do not think that we have the slightest bit of difference as to what is coming out and what is affecting the waters, that we can measure.

As I pointed out before, these are physical phenomena which can be measured. Whatever differences any of us may have in philosophy with the technical people in any of the agencies concerned -- and I want this to be on record -- as far as

their professional integrity is concerned there has never been the slightest doubt in anyone's mind as to the free exchange of scientific information, and we have no problems with it in our dealings with the information from these two agencies, just as I expect they do not have any problems in dealing with our information.

I would say this: Again we have an open mind. If anyone has made a mistake, and if our technical people are wrong on their facts or scientific data, anyone who can present evidence as to that, and not just set us off on a frolic, and have a reasonable doubt as to what we or anyone else are doing, we will be happy to receive that information.

Does anyone else want to say anything or make a statement?

STATEMENT OF JAMES PFAFFLIN
REPRESENTING A CITIZENS GROUP IN NEW JERSEY

MR. PFAFFLIN: Mr. Chairman. My name is Pfafflin. I represent a citizens group.

MR. STEIN: Would you give us your full name?

MR. PFAFFLIN: James Pfafflin -- P-f-a-f-f-l-i-n. I represent a citizens group in New Jersey.

We are quite disturbed concerning Raritan Bay. I submit it is impossibly polluted with everything so far identified by science, and things that I am sure have not yet been identified. I am very disturbed about this reclassification that is apparently pending. Today we have been told by the various State agencies we intend to clean up the bay. However, I was not too long ago told by a high and quite competent State official that some day we will have to face up to giving up the Outer Raritan Bay as a recreational area because of its location in the middle of a great industrial complex.

That came, I shall only say, from a high State official for whom I have the highest regard and respect. But there is a philosophy apparently somewhere in the background that is not at all in keeping with that stated today. I think it should be brought before the conferees.

MR. STEIN: Thank you, Mr. Pfafflin. I think, one, in the August 1961 conference that all the conferees agreed there is pollution of these waters.

Secondly, again I think the record here speaks for itself.

I just want to make one point. We have heard the New York City representative come forward with maps and detailed plans for recreational use of Raritan Bay, among others, aside from New Jersey and the beaches. I would think if you are talking about a situation of an opinion from an anonymous official that the bay was not to be used for recreation, I doubt whether New York City, with all of its resources and the expertise they have, would really put forward on a public record a plan for recreational use of the bay. It is clear

that New York City intends to make recreational use of the bay, and the record so states. Unless we can get any solid information to the contrary, I think we have to go along with the record.

Are there any other statements?

STATEMENT OF MARTIN FELDMAN, REPRESENTING
NORTH JERSEY COMMERCIAL FISHERMEN'S ASSOCIATION

MR. FELDMAN: My name is Martin Feldman and I represent the North Jersey Commercial Fishermen's Association. I have heard here today that since 1957 there have been surveys going on, and there has been a bettering of the bay, and things.

In 1961 the bay was in such a bad condition it was closed down, and we are the people who are most immediately affected. Everyone was thrown out of work. The bay has been cleaned up partly. We would like to know when these men will be able to go back to work, or is it going to be caught in Government bureaucracy and go on for ten, fifteen or twenty years?

Is there anything in the foreseeable future where these men will be able to go back to work soon?

MR. STEIN: I don't know that I can answer that question. You may have to ask the State and interstate people. However, as far as Government bureaucracy going on for ten or fifteen years, you have heard the time schedule of our technical people, and the agreement here that we expect to take about another year to complete the survey. I don't know, unless the States and the Interstate Agency abruptly change their attitude, that they are really going to extend our invitation much longer.

So I would suspect that in about a year we will have our technical report lined up.

Now, as far as the Federal law and our system of government is concerned, the primary rights and responsibilities for water pollution control, and certainly the control of shellfish harvesting, rest with the States. We have to take the law as it is, whether we agree with it or not, and some of us agree with it.

My suggestion is, this should be directed to the States. I do not know what they will tell you.

DR. KANDLE: I would like to make this point, Mr. Feldman, for the record, that is, that the abatement program, as Mr. Stein pointed out, started long before the Public Health Service conference, and will continue irrespective of the Public Health Service conference. The abatement program is going on now. It is not being delayed, nor are we waiting for the results. We will be glad to use them as they come along, but we are not standing still, and we are not waiting for any results from the Public Health Service or anybody else. We are working in a number of research problems, and not just research, but I mean

very practical problems, as you know.

To be specific, it would seem to me that in the most critical area you are interested in, Mr. Feldman, it is clear that the action of Highlands and Atlantic Highlands would speed things up faster than anybody else. Those decisions are made by those municipalities. They put up the money and they vote the bonds, and the rapidity with which they move will help to clean up that bay.

MR. FELDMAN: You brought up the question of Highlands. I don't think Highlands is a very big contributing factor because the outfall of Highlands goes out to the Atlantic Ocean, and the outfall pipe runs along under the river, and that pipe has been cracked for years. Between that crack in the pipe and Raritan Bay there is an open area that is not polluted. So I don't know if Highlands is a big contributing factor. I mean, there are other factors along the way. But what we are interested in is how long it will be in the immediate future before we will have the use of that bay. Is there any idea?

DR. KANDLE: I cannot venture one, to be frank with you.

MR. STEIN: I think in a year, when the study is completed, we will be in a much better position at least to give you a prognosis, or to say after the study, we don't know and we can't tell you.

MR. FELDMAN: That's all we have been hearing.

MR. STEIN: No. Wait a moment. I don't think you have been hearing this. This is what I wanted to point out. What you have to recognize here is that the Raritan Bay situation, looking at this as a national pollution situation, is a very, very difficult and complex one. There are two reasons for this: One, we are dealing with tidal waters that our people do not know too much about and it is very, very difficult to ascertain. You have heard some of the studies. For the first time I have found out how material gets dispersed in Raritan Bay. This was the kind of thing I asked about last year, and no one knew the answers to it.

Secondly, we do not have cities and industries in large measure pouring wastes in raw. By and large they are providing some kind of treatment. The question here is a very, very subtle, discreet and discriminatory one. I think the study has to indicate the effects of the industrial and population explosion in this area as indicated by Dr. Kandle in his statement, and the kind of treatment you can expect, and what can be done with Raritan Bay. I can assure you from our point of view that our objective is to preserve within the realms of feasibility any legitimate water use that can be achieved. I am certain that Dr. Kandle -- and I have seen this in operation -- has the same thing in mind. As far as I know, he has never been arbitrary and capricious in closing a shellfish area, and his objective is to keep open as many as possible.

I think at the end of this year we will be in a position at least, or I hope our technical people will be in a position, to provide some kind of answer on this, and a prognosis.

MR. FELDMAN: I just want to ask one more thing: Do you think that Raritan Bay will ever be open to shellfish again?

DR. COLOSI: It is open now.

MR. STEIN: Part of it. Can't you wait? I think I would like to answer that, and the way I would like to answer that is to wait for our scientific data to come in and hear what our technical people have to say, and hear what the State and interstate people have to say after evaluating the technical data before we can make a judgment on it. Isn't this a fair proposition?

MR. FELDMAN: That is very fair, but these men that work on the water and live from day to day, they can't wait that year.

MR. STEIN: By the way Mr. Feldman, I can appreciate this. We have situations in the Pacific Northwest which affect people in the same way. The problem that we have here is a tremendously difficult scientific problem. You need the year in order to get the answer. By the same token, some people might say that we cannot wait the year to achieve parity with the Russians in acquiring the thrust to get a rocket or a satellite up into space. But research and development have to take just so long, and this is a hard reality we have to deal with.

Mr. Feldman, if we could give you the answers here today, we would be delighted to.

MR. FELDMAN: So would I.

MR. STEIN: Our technical people do not have the answers today. They have indicated in another year they will be in a better position to do so.

MR. FELDMAN: Okay. Thank you.

MR. STEIN: Are there any further comments or questions?

STATEMENT OF NORMA CIRELLA
PRIVATE CITIZEN

MRS. CIRELLA: Yes, sir. Mrs. Cirella. I am just a private citizen.

Mr. Stein, thirty years ago --

MR. STEIN: May we have your first name?

MRS. CIRELLA: Norma.

You are looking at someone who carries the scars from water pollution for thirty years. I don't wish on a dog what I suffer every day in the week. Thirty years I am waiting for an answer and when is it going to come? Thirty multiplied by what before we get the answer? Can you tell me?

MR. STEIN: Again let me repeat --

MRS. CIRELLA: I would not put a dead dog in that water.

MR. STEIN: Let me repeat what I have told Mr. Feldman, that is, that everyone would be delighted to give you an answer now. What we have in Raritan Bay both the Federal Government, the States and the Interstate Agency -- and I don't care who else you put out there to study Raritan Bay -- they will tell you that in Raritan Bay you have one of the most difficult scientific problems to crack. Until we can get the scientists to come up with an answer and be able to give us the answer to that, we are not going to be able to provide it to anyone.

We said that the scientists set up a study for two years. They all recognize how long this will take.

I appreciate your impatience with this and I appreciate the fact that you would like, and everyone would like to have it pristine water, or have the thing cleared up tomorrow, or have a scientific answer tomorrow. The point is that this is the kind of business where I think we are proceeding in a reasonable and rapid fashion. We are not delaying. We are not procrastinating. We have given this top priority on the Federal level and we are moving ahead as fast as we can to get the answers.

MRS. CIRELLA: I say there should be a Federal investigation.

MR. STEIN: There is. Haven't you been listening?

MRS. CIRELLA: You read the papers and all you hear is figures and statistics and what not. That water is so polluted I wouldn't put a dead dog in it.

MR. STEIN: All right.

Are there any further comments or questions?

If not, we appreciate all of these, and we really thank you for coming. You don't realize how pleasant this is to me because the sense you get from listening and talking to the people out here is quite a little bit different than that rarefied ivory tower atmosphere I have in Washington.

Thank you very much.

(Whereupon, at 2:45 p.m., the conference was adjourned sine die.)

APPENDIX A

A-1

RARITAN BAY PROJECT

TABLE A-1. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962

Bay Stations									
Densities per 100 milliliters									
Station	CONFIRMED COLIFORM			FECAL COLIFORM			FECAL STREPTOCOCCUS		
	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum
1-S	20	73	350	18	27	240	25	49	45,000
1-D	20	77	920	19	37	350	16	39	3,900
2-S	20	76	1,600	17	29	350	17	86	7,300
2-D	19	51	920	16	27	540	24	99	50,000
3-S	20	160	3,500	17	55	1,700	24	71	250,000
3-D	19	170	3,500	16	75	1,700	17	100	140,000
4-S	20	560	16,000	17	38	5,400	17	51	15,000
4-D	19	540	9,200	17	290	9,200	21	170	51,000
5-S	17	1,200	9,200	14	380	5,400	22	170	160,000
5-D	18	1,600	16,000+	15	590	16,000	17	98	3,100
6-S	15	3,300	54,000	12	1,600	16,000+	16	120	4,200
6-D	16	4,600	35,000	13	1,300	35,000	21	340	100,000
7-S	17	3,100	16,000+	16	1,900	16,000+	20	160	4,000
7-D	17	3,600	16,000+	16	2,000	16,000	16	220	100,000
8-S	15	2,600	40,000	13	820	16,000	17	52	2,300
8-D	17	1,100	16,000+	15	460	9,200	22	240	15,000
9-S	17	1,300	17,000	14	830	11,000	22	130	5,000
9-D	15	660	5,400	14	250	4,900	17	78	2,600
10-S	16	2,400	16,000+	14	960	9,200	17	160	240,000
10-D	16	2,100	16,000+	14	790	16,000	21	250	350,000

RARITAN BAY PROJECT

TABLE A-1. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962 (Cont.)

Bay Stations											
Densities per 100 milliliters											
Station	CONFIRMED COLIFORM			FECAL COLIFORM			FECAL STREPTOCOCCUS				
	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum		
11-S	15	830	16,000+	11	590	3,500	21	300	140,000		
11-D	15	840	16,000+	11	580	2,400	17	130	19,000		
12-S	16	410	5,400	14	180	1,600+	17	49	51,000		
12-D	16	580	9,200	13	160	1,600	21	70	87,000		
13-S	15	100	920	12	46	920	20	74	150,000		
13-D	15	100	540	12	45	350	17	150	130,000		
14-S	15	42	1,600+	13	15	920	18	110	320,000		
14-D	15	57	1,600+	13	21	920	20	61	7,700		
15-S	13	44	1,800	10	11	130	19	48	40,000		
15-D	13	35	920	9	12	540	15	120	90,000		
16-S	13	26	1,600	12	13	350	14	56	45,000		
16-D	13	39	540	12	20	350	19	140	20,000		
17-S	15	240	2,400	12	130	1,600+	20	63	66,000		
17-D	15	270	1,700	12	140	1,600+	16	38	12,000		
18-S	15	360	3,500	12	210	2,400	15	22	14,000		
18-D	15	660	9,200	12	290	3,500	18	100	60,000		
19-S	14	1,000	16,000+	10	510	3,500	20	50	10,000		
19-D	13	1,800	16,000	10	830	16,000	15	150	38,000		
20-S	14	1,400	16,000+	11	690	5,400	16	170	2,200,000		
20-D	15	2,600	17,000	11	860	16,000	20	160	39,000		

RARITAN BAY PROJECT

TABLE A-1. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962 (Cont.)

Bay Stations

Densities per 100 milliliters

Station	CONFIRMED COLIFORM			FECAL COLIFORM			FECAL STREPTOCOCCUS		
	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum
21-S	13	870	16,000+	11	350	5,400	17	75	150,000
21-D	13	1,600	16,000	11	560	5,400	14	250	61,000
22-S	14	930	16,000+	12	400	3,500	16	85	35,000
22-D	14	1,300	9,200	11	500	3,500	18	100	43,000
23-S	12	380	9,200	7	380	9,200	17	34	12,000
23-D	12	640	16,000	7	420	5,400	14	280	110,000
24-S	13	110	1,600+	12	74	1,600+	15	53	23,000
24-D	13	250	1,600+	12	140	1,600	17	35	4,000
25-S	13	220	1,600+	11	210	1,600+	18	35	20,000
25-D	13	500	2,200	10	290	1,600+	16	56	9,800
26-S	12	300	1,700	10	190	1,600+	14	19	3,300
26-D	12	760	5,400	9	390	3,500	16	64	7,600
27-S	12	160	3,500	8	40	540	17	37	7,000
27-D	12	280	2,400	8	66	790	15	35	2,700
28-S	13	130	540	9	95	540	14	30	2,000
28-D	13	130	1,600	9	110	920	17	80	4,800
29-S	13	43	540	9	16	140	17	58	60,000
29-D	13	71	540	9	25	170	14	24	200
30-S	16	81	1,600	12	39	540	15	64	3,800
30-D	16	99	540	13	25	350	20	76	1,900

RARITAN BAY PROJECT

TABLE A-1. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962 (Cont.)

Bay Stations										
Densities per 100 milliliters										
Station	CONFIRMED COLIFORM			FECAL COLIFORM			FECAL STREPTOCOCCUS			
	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	
31-S	16	160	1,600+	13	66	1,600	20	29	940	
31-D	16	110	920	12	40	540	15	27	260	
32-S	17	500	9,200	13	170	9,200	14	58	45,000	
32-D	17	360	16,000+	13	100	1,600	20	130	83,000	
33-S	18	2,000	16,000+	13	540	9,200	20	87	3,000	
33-D	17	710	16,000	12	290	16,000	17	67	45,000	
34-S	17	1,400	16,000	13	740	16,000	15	79	31,000	
34-D	17	1,200	24,000	13	480	1,600+	18	85	2,300	
463-S	16	9,000	54,000	11	2,400	35,000	18	140	1,300	
463-D	15	7,200	17,000	10	3,100	16,000	13	360	230,000	
*45-S	5	67	240	5	13	49	6	88	48,000	
46-S	4	71	1,100	4	20	490	5	37	200	
47-S	5	59	350	5	14	170	6	78	25,000	
48-S	4	36	79	4	12	49	5	28	160	
49-S	2	22		2	7		3	78		
50-S	2	47		2	16		3	190		
51-S	2	47		2	8		3	360		
52-S	5	55	1,600	5	9	280	5	120	300	
53-S	2	22		2	3		3	140		
54-S	5	140	350	5	16	130	5	1,300	42,000	

RARITAN BAY PROJECT

TABLE A-1. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962 (Concl.)

Bay Stations										
Densities per 100 milliliters										
Station	CONFIRMED COLIFORM			FECAL COLIFORM			FECAL STREPTOCOCCUS			
	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	
55-S	5	460	2,200	5	57	1,100	5	690	8,000	
56-S	3	200		3	49		3	2,000		
58-S	5	610	16,000	5	36	120	6	1,200	220,000	
59-S	5	440	1,600+	5	49	1,600+	4	470	15,000	
60-S	5	2,500	16,000+	5	120	1,600+	5	510	100,000	
61-S	3	2,800		3	1,100		3	1,800		
62-S	5	10,000	35,000	5	1,500	22,000	5	1,900	2,000	
64-S	5	3,700	35,000	6	250	490	6	4,000	170,000	
65-S	6	3,100	92,000	6	240	350	7	240	1,600	

* Stations 45 to 65 sampled Oct - Dec 1962.

RARITAN BAY PROJECT

TABLE A-2. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962

Shore Stations

Densities per 100 milliliters

Station	CONFIRMED COLIFORM			FECAL COLIFORM			FECAL STREPTOCOCCUS		
	N	Geometric		N	Geometric		N	Geometric	
		Mean	Maximum		Mean	Maximum		Mean	Maximum
New Jersey									
701	20	55	920	10	25	130	24	28	15,000
702	19	240	1,700	12	48	790	26	68	11,000
703	18	96	1,300	11	36	350	26	44	500
704	19	190	9,200	13	69	3,500	27	93	28,000
705	21	140	3,500	11	22	140	28	170	26,000
706	21	420	9,200	14	120	2,400	27	130	4,100
707	21	310	16,000+	13	47	490	28	100	5,600
708	20	470	16,000+	13	49	490	27	95	8,300
709	16	320	1,700	9	96	790	24	180	12,000
710	20	420	16,000+	15	72	490	28	280	72,000
711	15	280	9,200	8	120	1,300	21	120	3,900
712	15	190	1,600+	10	50	540	22	340	8,000
713	10	480	16,000	7	160	3,500	17	740	240,000
714	8	320	1,600+	7	140	920	16	600	260,000
715	6	500	1,600+	6	200	1,600+	12	120	25,000
716	7	1,300	1,600+	6	1,200	1,600+	12	310	2,200

RARITAN BAY PROJECT

TABLE A-2. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962 (Concl.)

Shore Stations													
Densities per 100 milliliters													
CONFIRMED COLIFORM				FECAL COLIFORM				FECAL STREPTOCOCCUS					
Station	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	
New York													
601	21	3,900	160,000	14	620	54,000	27	260	4,100				
602	21	2,500	70,000	16	720	54,000	27	140	28,000				
603	20	1,300	54,000	13	260	4,900	26	56	1,200				
604	20	1,700	16,000+	17	560	4,600	26	46	5,500				
605	19	650	3,500	13	190	920	26	48	9,000				
606	20	380	2,200	16	140	1,600	27	68	700				
607	19	340	1,600	12	95	490	24	110	688,000				
608	21	380	16,000	16	150	9,200	26	120	3,200				
609	17	160	790	11	46	350	23	100	35,000				
610	13	140	1,600+	9	36	1,600+	18	150	190,000				
611	14	380	5,400	9	86	460	20	92	2,400				
612	16	390	9,200	11	190	3,500	22	140	4,000				
613	16	320	6,000	13	140	16,000	21	360	4,600				
614	9	270	1,600+	8	160	1,600+	14	67	8,600				
615	8	370	2,200	7	140	1,600+	13	430	11,000				
616	7	710	7,900	7	210	2,200	12	990	56,000				
617	5	690	1,600+	5	250	1,600+	9	400	13,000				

RARITAN BAY PROJECT

TABLE A-3. SUMMARY OF CHEMICAL DATA JUNE - DEC 1962

Station	N	Average Temp °C	Average Chloride (mg/l)	Bay Stations				DISSOLVED OXYGEN		
				mg/l		Percent Saturation		Average	Minimum	Maximum
				Average	Minimum	Average	Minimum			
1-S	26	17.2	13900	6.76	4.10	80	53			
1-D	26	17.2	14000	6.31	4.30	74	53			
2-S	26	17.1	13900	6.50	4.73	81	59			
2-D	26	17.1	14000	7.78	4.48	80	58			
3-S	25	17.0	14000	6.88	4.60	81	54			
3-D	26	17.0	14100	6.67	4.60	78	54			
4-S	25	17.0	14100	6.62	4.50	78	53			
4-D	26	16.9	14200	6.44	4.50	75	53			
5-S	24	16.8	14100	6.17	4.00	73	53			
5-D	24	16.8	14300	5.96	4.30	69	50			
6-S	22	17.4	14200	6.02	4.10	71	47			
6-D	22	17.1	14400	6.03	4.10	70	49			
7-S	22	17.4	14200	5.89	3.64	69	46			
7-D	23	17.3	14600	5.92	4.18	70	53			
8-S	23	17.1	14400	6.13	3.11	72	42			
8-D	23	16.6	15400	6.43	4.23	77	55			
9-S	23	17.1	14700	6.24	3.58	73	48			
9-D	23	17.0	15400	6.27	4.42	74	58			
10-S	23	17.3	14300	6.23	3.24	74	42			
10-D	23	17.0	14800	6.02	3.71	71	48			

RARITAN BAY PROJECT

TABLE A-3. SUMMARY OF CHEMICAL DATA JUNE - DEC 1962 (Cont.)

Station	N	Average Temp °C	Average Chloride (mg/l)	DISSOLVED OXYGEN				Percent Saturation	
				mg/l		Average	Minimum	Average	Minimum
				Average	Minimum				
11-S	20	17.7	14600	6.41	4.19	77	56		
11-D	20	17.7	14700	6.23	4.06	74	52		
12-S	20	17.9	14400	7.02	5.15	84	63		
12-D	20	18.0	14700	6.83	5.13	83	63		
13-S	20	18.0	14500	7.60	5.90	92	75		
13-D	20	17.9	14800	7.26	5.80	87	66		
14-S	20	18.1	14300	7.79	5.80	100	69		
14-D	20	17.9	14300	7.04	4.80	84	62		
15-S	20	17.6	12900	8.81	5.60	106	66		
15-D	20	17.8	13900	7.85	5.30	94	62		
16-S	19	17.6	13900	8.51	5.60	102	66		
16-D	19	17.3	14200	7.14	4.20	84	53		
17-S	21	18.0	14200	7.77	5.60	94	68		
17-D	21	17.8	14600	7.03	5.10	84	60		
18-S	20	17.8	13500	7.48	5.00	90	60		
18-D	20	17.6	14500	6.53	4.95	78	61		
19-S	19	17.3	14100	6.77	4.63	80	57		
19-D	19	17.3	14500	6.34	4.77	75	57		
20-S	20	17.4	14100	6.35	4.26	74	52		
20-D	20	17.5	14200	6.09	3.69	41	47		

RARITAN BAY PROJECT

TABLE A-3. SUMMARY OF CHEMICAL DATA JUNE - DEC 1962 (Cont.)

Station	N	Average Temp °C	Average Chloride (mg/l)	Bay Stations				DISSOLVED OXYGEN		
				Average	mg/l	Percent Saturation		Average	Minimum	
						Average	Minimum			
21-S	18	18.6	14200	6.30	4.10	77	4.10	77	52	
21-D	18	18.3	14200	5.69	4.31	71	4.31	71	55	
22-S	18	19.0	14100	7.17	4.80	88	4.80	88	58	
22-D	18	18.7	14400	6.37	4.50	74	4.50	74	54	
23-S	17	18.6	14100	7.64	5.50	93	5.50	93	65	
23-D	17	18.3	14300	6.26	4.60	75	4.60	75	55	
24-S	16	19.1	14100	8.27	5.50	104	5.50	104	64	
24-D	17	18.7	14500	6.41	5.30	78	5.30	78	63	
25-S	17	19.0	14000	8.07	4.20	100	4.20	100	53	
25-D	17	18.7	14200	6.27	4.60	76	4.60	76	56	
26-S	17	18.6	14100	7.59	5.17	94	5.17	94	63	
26-D	17	18.4	14200	6.39	4.80	76	4.80	76	57	
27-S	17	18.9	14100	8.19	5.50	102	5.50	102	66	
27-D	17	18.6	14200	5.84	4.70	80	4.70	80	56	
28-S	18	19.3	14000	7.65	5.30	95	5.30	95	61	
28-D	18	18.8	14100	6.83	4.90	84	4.90	84	60	
29-S	18	19.2	14000	7.26	2.30	90	2.30	90	29	
29-D	18	18.9	14000	6.36	2.40	78	2.40	78	30	
30-S	20	17.3	13700	7.02	3.00	82	3.00	82	35	
30-D	20	17.1	13900	6.48	3.50	75	3.50	75	144	

RARITAN BAY PROJECT

TABLE A-3. SUMMARY OF CHEMICAL DATA JUNE - DEC 1962 (Cont.)

Bay Stations				DISSOLVED OXYGEN				Percent Saturation	
Station	N	Average Temp °C	Average Chloride (mg/l)	mg/l		Average		Minimum	Minimum
				Average	Minimum	Average	Minimum		
31-S	21	17.4	13600	7.08	4.40	84		53	
31-D	21	17.1	13900	6.44	4.10	75		52	
32-S	21	17.9	13200	6.42	3.50	76		42	
32-D	21	17.6	13700	5.81	4.10	68		49	
33-S	21	18.0	13000	5.63	2.50	66		32	
33-D	21	17.7	13200	5.48	3.30	64		40	
34-S	21	18.2	13000	5.43	2.90	65		34	
34-D	21	17.9	12500	5.19	2.40	61		30	
463-S	17	16.9	11200	5.28	2.20	59		28	
463-D	17	17.1	12200	4.97	2.00	55		25	
*45-S	6	12.3	13000	6.25	4.50	65		50	
46-S	5	11.6	13000	6.68	4.90	68		58	
47-S	6	12.3	13600	6.92	4.95	73		60	
48-S	5	12.2	13300	7.37	5.70	78		67	
49-S	3	8.3	13100	8.22		81			
50-S	3	8.8	13300	8.37		83			
51-S	3	8.5	13200	8.60		85			
52-S	6	12.1	12600	7.22	5.40	76		63	
53-S	3	9.1	12300	8.10		81			
54-S	6	11.9	12300	6.30	3.57	65		43	

RARITAN BAY PROJECT

TABLE A-3. SUMMARY OF CHEMICAL DATA JUNE - DEC 1962 (Concl.)

Station	N	Average Temp °C	Average Chloride (mg/l)	Bay Stations				DISSOLVED OXYGEN		
				mg/l		Percent Saturation		Average	Minimum	Maximum
				Average	Minimum	Average	Minimum			
55-S	5	13.0	12300	5.78	3.33	60	40			
56-S	5	8.2	12700	7.06	4.30	68	48			
58-S	6	9.8	12800	6.37	3.95	63	44			
59-S	5	13.0	12000	5.35	3.52	56	42			
60-S	5	13.1	12200	4.69	2.60	49	32			
61-S	4	9.6	11000	5.89	4.20	58	47			
62-S	4	14.6	12700	4.25	2.40	45	27			
64-S	7	11.6	12000	5.42	2.90	53	35			
65-S	7	11.3	12000	5.37	3.00	54	36			

* Stations 45 to 65 sampled Oct - Dec 1962.

RARITAN BAY PROJECT

TABLE A-4. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962

Entrant Waters to the Bay

Densities per 100 milliliters

Station	CONFIRMED COLIFORM			FECAL COLIFORM			FECAL STREPTOCOCCUS		
	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum
100-S	7	27,000	32,000	6	9,700	24,000	5	670	7,700
100-D	7	9,600	35,000	6	5,400	24,000	4	670	3,400
101-S	9	30,000	92,000	9	6,000	24,000	11	2,600	39,000
101-D	9	16,000	92,000	9	3,900	22,000	11	660	27,000
102-S	7	19,000	35,000	7	6,600	16,000+	9	680	2,100
102-D	7	12,000	35,000	7	5,100	16,000	8	530	4,000
103-S	9	27,000	160,000	9	8,900	54,000	10	950	230,000
103-D	9	20,000	54,000	9	3,300	13,000	11	600	34,000
104-S	7	14,000	54,000	5	5,000	11,000	5	1,600	2,500
104-D	7	13,000	22,000	5	4,900	13,000	4	830	1,100
123-S	27	1,300	24,000	21	380	2,200	29	50	18,000
123-D	28	830	5,400	22	260	1,600	28	79	300,000
066-S	10	740	5,400	10	190	3,500	36	60	690
067-S	10	910	16,000	10	210	5,400	36	81	1,300

RARITAN BAY PROJECT

TABLE A-5. SUMMARY OF CHEMICAL DATA JUNE - DEC 1962

		Entrant Waters to the Bay			DISSOLVED OXYGEN			
Station	N	Average Temp °C	Average Chloride (mg/l)	Average mg/l	Minimum	Average	Percent Saturation	Minimum
100-S	7	10.7	14700	5.90	5.10	62	52	
100-D	7	10.4	16500	6.00	5.00	64	50	
101-S	14	14.6	14300	5.21	3.70	58	48	
101-D	14	14.2	14900	8.71	4.32	68	57	
103-S	14	14.4	13600	5.25	3.50	58	46	
103-D	14	14.3	14800	5.71	3.80	64	50	
104-S	7	10.1	13300	5.43	4.30	56	46	
104-D	7	10.5	14500	5.86	4.60	61	50	
123-S	12	19.8	10800	4.33	2.65	50	27	
123-D	12	19.5	12300	3.83	3.45	46	23	

RARITAN BAY PROJECT

TABLE A-6. SUMMARY OF BACTERIOLOGICAL DATA JUNE - DEC 1962

Sewage Treatment Plants

Densities per 100 milliliters

Sewage Treatment Plant	CONFIRMED COLIFORM MPN				FECAL COLIFORM MPN				MF STREPTOCOCCUS			
	N	Geometric Mean	Maximum	N	Geometric Mean	Maximum	N	Geometric Mean	N	Geometric Mean	Maximum	Maximum
Oakwood Beach	Inf 56 Eff 64	15,000,000 49	920,000,000 9,200	30 38	4,500,000 6	32,000,000 1,600	64 73	1,100,000 48	64 73	1,100,000 48	27,000,000 70,000	
Perth Amboy	Inf 79 Eff 99	35,000,000 35	54,000,000 16,000+	73 93	850,000 9	8,000,000 5,400	71 79	1,300,000 450	71 79	1,300,000 450	110,000,000 300,000	
Middlesex County	Inf 81 Eff 88	15,000,000 120	220,000,000 16,000,000+	77 83	1,200,000 9	160,000,000 1,600+	73 80	7,200,000 43	73 80	7,200,000 43	2,000,000,000 340,000	
South Amboy	Inf 70 Eff 84	8,600,000 32	240,000,000 16,000+	62 80	2,500,000 6	63,000,000 1,090	65 72	1,900,000 51	65 72	1,900,000 51	78,000,000 770,000	
Keyport	Inf 54 Eff 83	2,200,000 13	350,000,000 16,000+	51 81	660,000 5	220,000,000 16,000+	37 44	720,000 82	37 44	720,000 82	35,000,000 66,000	
Keansburg	Inf 60 Eff 67	4,600,000 930	54,000,000 16,000+	52 80	1,400,000 30	13,000,000 16,000+	54 58	370,000 21	54 58	370,000 21	50,000,000 250,000	
Atlantic Highlands	Inf 59 Eff 89	400,000 72	350,000 160,000+	55 86	72,000 11	70,000,000 160,000+	68 75	800,000 63	68 75	800,000 63	36,000,000 1,700,000,000	
Highlands	Inf 80 Eff 112	13,000,000 60	160,000,000 16,000+	72 106	4,500,000 17	350,000,000 16,000+	89 83	1,400,000 95	89 83	1,400,000 95	46,000,000 940,000	

APPENDIX B

B-1

METHODOLOGY

Station Locations

A sampling program for the waters of Raritan Bay and its tributary streams and sewage treatment plant effluents was based on an extensive review of data collected, through 1961, by state and interstate agencies in the area.

The network of Project sampling stations was designed to (1) characterize the gradient of water quality within the bay and (2) make maximum use of existing information. There is a station for approximately every two square miles of water area; station designations and coordinate locations are shown in Table B-1. This table also indicates those stations sampled regularly by state and interstate agencies.

A series of stations along the shores of Staten Island and New Jersey were used to characterize the quality of waters in and along the shorelines. The shoreline stations on Staten Island largely duplicate those sampled by the New York City Department of Health.

Sampling Schedule

Frequency of sampling is as important as the location of stations. Changes in water quality characteristics in relation to time were analyzed from previously accumulated data; this data suggested that long term or seasonal characteristics have the more important effects on water quality (because of the averaging effects of the tidal embayment).

Therefore, the program was designed to provide consecutive, equally-spaced samples over a period of one year--at intervals of approximately one week. This program consisted of weekly (Tuesday) samplings of: 54 bay stations at surface; 35 bay stations at bottom depth; 33 shoreline stations at surface; 8 major sewage treatment plants. Certain practical limitations (e.g. weather problems, mechanical failure of boats) forced occasional adjustment of this schedule to Monday or Wednesday. This program has been maintained since June 1962.

Other sampling is conducted to determine short term variations in water quality. Each major treatment plant has been sampled hourly over a 24-hour period on two or more occasions. Cross-sections of various entrant streams (including the Narrows, Arthur Kill and Raritan River) have been studied for periods of six or more hours.

Sampling Methods

Bay Stations: Surface samples of bay water are collected five

feet below the water surface; deep samples are collected five feet above the bottom--using a Kemmerer water bottle (standard oceanographic sampling unit for estuarial work). The Kemmerer bottle contains approximately 2,200 ml of sample collected at a prescribed depth by a messenger-actuated closure device.

The sample is drawn from the bottle, by means of a rubber tube and valve arrangement, into various sampling containers for specific analytical purposes. The first portion of the sample is used to measure dissolved oxygen; the second portion to measure temperature and conductivity; the third portion (approximately mid-volume of the sampling container) to determine bacteriological quality; the last portion is used for various other analyses as may be required.

Dissolved oxygen samples are fixed and titrated aboard the sampling vessel within about 30 minutes of collection. Bacteriological samples are plated or planted within about ten minutes of collection. All MPN tubes and membrane filters--after inoculation aboard the sampling vessel--are returned to the laboratory within a maximum time of six hours for incubation, counting and further differentiation.

Temperature and conductivity measurements are made aboard the sampling vessel immediately upon collection of the samples.

Analyses for biochemical oxygen demand (or other specific constituents) are made upon iced or fixed samples as the procedures in Standard Methods prescribe; this is done after return of the samples to the laboratory.

Shore Stations: At all shore stations, sampling procedures are carried to completion in station wagons equipped to operate as small field laboratories. Shoreline samples are collected in four-ounce ground-glass-stoppered sterile containers; the samples are collected from the surf by wading out to points approximately two feet deep. Time of planting and analyses schedules are the same as aboard the boats.

Treatment Plants: Sampling procedures at the treatment plants closely parallel methods used in the bay and on the shores. There is one exception: bacteriological samples of chlorinated effluents are held in the chlorinated state for a period of time equivalent to the time plant effluents require to pass from the point of collection to the point of entrance into bay waters. After this time interval the samples are dechlorinated.

The holding time is estimated on basis of the flow and hydraulic characteristics of the treatment plant contact chamber and outfall. In any case, samples are not held longer than 30 minutes. Dechlorination is accomplished by addition of sterile thiosulfate solution.

RARITAN BAY PROJECT

TABLE B-1. LOCATION OF SAMPLING STATIONS

PHS Number	Shore Line	N.Y.C. Health Dept.
	New York Shore	
601	South Beach, Field 5, Lane 1, foot Sand Lane	75
602	South Beach, Field 4, Lane 8, by 445 Seaside Blvd.	79
603	South Beach, by 517 Seaside Blvd., Parking Gate 4	79A & SB-1
604	South Beach, foot Seaview Ave, end of fence	
605	South Beach, foot Lincoln Ave, Section A, Lane 1	81
606	New Dorp Beach, foot New Dorp Lane	83
607	Foot Fox Lane	
608	Great Kills Park, north of bath house	PD-2
609	Great Kills Park, Crookes Point, rock jetty	CP-1
610	Great Kills Yacht Club	GKH-1
611	Annadale Beach, foot Lipsett Ave	85
612	Huguenot Beach, foot Huguenot Ave	87
613	Wolf Pond Park	90
614	Princess Bay, foot Sequine Ave	91
615	Mt. Loretto, front of bath houses	138
616	Tottenville, foot Manhattan St.	139
617	Tottenville, foot Hylan Blvd.	
	New Jersey Shore	
701	Highlands, Shrewsbury River Bridge on Route 36	
702	Highlands, Water Witch Beach, foot Central Ave	
703	Atlantic Highlands, foot First Ave	
704	Leonardo, Conover Beach, foot Leonardo Ave	
705	Port Monmouth, E. Kay's Beach, 1/2 mile W. Wilson Ave	
706	E. Keansburg, Ideal Beach, foot Hudson Ave	
707	Keansburg, Main Street Beach, foot Maint St.	
708	Keansburg, Beach, Grandview and Beachway	
709	Keansburg, Belvedere Beach, foot Oakwood Place	
710	Raritan, Union Beach, Florence Ave and Front St.	
711	Keyport Beach, foot Cedar St.	
712	Cliffwood Beach, foot Lakeshore Dr.	
713	Madison Township Recreation Area	
714	Morgan Beach, foot Cliffwood Way	
715	Morgan, West side Cheesequake Creek	
716	Perth Amboy Beach, foot State Street	
	Sewage Treatment Plants	
803	Oakwood Beach Pollution Control Plant	
842	Perth Amboy Sewage Treatment Plant	
854	Middlesex County Sewerage Authority	
860	South Amboy Sewage Treatment Plant	
875	Keyport Sewage Treatment Plant	
878	Keansburg Sewage Treatment Plant	
884	Atlantic Highlands Sewage Treatment Plant	
887	Highlands Sewage Treatment Plant	

B-2-a

RARITAN BAY PROJECT

TABLE B-1. LOCATION OF SAMPLING STATIONS (Cont.)

Bay Waters						
P.H.S. CODE	74° LONGITUDE		40° LATITUDE		OTHER AGENCY CODE NUMBER	
	MIN	SEC	MIN	SEC	NEW YORK CON. DEPT.	NEW JERSEY HEALTH DEPT. I.S.C.
<u>Bay Stations</u>						
1	9	52	30	14	39	
2	8	38	30	27	59	
3	7	21	30	41	57	
4	6	6	30	54	9	
5	5	17	32	3	81	
6	4	5	32	17	86	
7	2	43	32	30	90	
8	1	37	32	40		
9	1	13	31	45		
10	2	27	31	32	92	
11	2	8	30	34	94	3
12	1	52	29	37		12
13	1	34	28	39		78
14	1	17	27	42		
15	0	59	26	44		
16	2	19	26	30		101
17	2	54	28	25		80
18	3	11	29	23		45
19	3	28	30	20	88	5
20	3	45	31	18	87	
21	5	2	31	4	82	
22	4	14	30	7	83	7
23	4	27	29	10		47
24	4	10	28	12		82
25	5	32	28	58		49A
26	5	49	29	56	11	8A
27	7	5	29	44	13	10
28	8	20	29	31	15	11A
29	9	36	29	18	17	13
30	11	18	30	32	38	
31	12	26	30	20	36A	
32	13	45	29	28	34	
33	15	2	29	29	26	
34	15	32	30	6		

RARITAN BAY PROJECT

TABLE B-1. LOCATION OF SAMPLING STATIONS (Concl.)

Bay Waters							
P.H.S. CODE	74°		40°		OTHER AGENCY CODE NUMBER		
	LONGITUDE		LATITUDE		NEW YORK CON. DEPT.	NEW JERSEY HEALTH DEPT.	I.S.C.
MIN	SEC	MIN	SEC				
45	10	53	29	5	19	14A	
46	9	20	28	21		53	
47	8	4	28	34		51A	
48	6	54	28	45		50	
49	5	14	28	2		83A	
50	3	52	27	15		97A	
51	4	56	28	5		97B	
52	6	30	27	49		85	
53	9	3	27	25		63A	
54	10	35	28	7		54A	
55	11	45	27	57		56	
56	12	0	28	54	21	16	
58	13	30	28	38	23	18	
59	13	11	27	41		58	
60	14	46	28	27			
61	14	55	29	7	30	20A	
62	16	10	29	23			
64	15	12	28	52			1-6
65	15	12	28	52			1-6
Bay Entrance Stations							
Arthur Kill							
66	15	40	30	20			
67	15	24	30	44			
Narrows							
100	2	25	36	35			
101	2	36	36	31			
102	2	47	36	28			
103	2	58	36	24			
104	3	10	36	21			
Raritan River							
463	16	59	29	49			

B-2-a

Temperature and pH measurements are made on collection. Iced samples are returned to the laboratory for analysis for suspended solids (volatile and fixed), and for biochemical oxygen demand.

Laboratory Procedures

In chemical and bacteriological determinations, the procedures recommended by the 11th Edition of Standard Methods for the Examination of Water and Wastewater were followed whenever applicable.

Coliforms were determined by the multiple tube procedure; an additional test for the confirmation of coliforms (utilizing an elevated temperature of 44.5°C.) was added for the identification of the fecal coliforms present.

The streptococcal group was also determined routinely, using KF media by membrane filter procedure. The validity of these counts was confirmed by adequate comparison of split samples, using both KF and M-Enterococcus Media, followed by the identification of random colony picks from positive plates.

Chlorides were determined by using the mercuric nitrate procedure; confirmation was with a salinometer calibrated for sea water.

Biochemical oxygen demand was determined by the standard five-day, 20°C., incubation in a covered water bath.

All pH measurements were made in the field, using a portable pH meter standardized with standard buffer solution at regular intervals in the field.

Thermometers used for measuring temperatures were standard mercury glass thermometers, calibrated to 1/10°C.

BIOLOGICAL STUDIES

Introduction. Industrial and domestic discharges into Raritan Bay and adjacent waters impose another factor on the already complex assay of the natural environment. The evaluation of the effect of these discharges on the biology of the bay¹, exclusive of the natural ecology, is difficult. The history of shellfish, the former economic resource of the bay, is well documented with evidence which relates its decline to both manmade and natural causes (Nelson, 1960). For the present at least, the harvesting of shellfish is prohibited. Unfortunately, there are no inclusive histories of other organisms to compare past populations with the present. Jeffries (1959) and Patten (1959) studied the plankton during the years 1957-1959, but their stations did not exceed the outer limits of a line from Great Kills to Point Comfort. Dean (unpublished data) conducted benthic surveys of the bay from 1956-1960. His sampling was limited to only short summer periods.

The present objectives of the biological program for this project are to describe qualitatively and quantitatively the biological populations of the bay, and to relate existing natural and manmade environmental effects where possible. To carry out the aim of this project, a survey of the biological populations is being conducted of both the plankton and the benthos. Samples are examined with respect to kinds, numbers, associations and changes thereof. Although lagging behind the advances made in fresh-water biology, there are accepted pollution tolerant organisms and community structures which differentiate polluted from non-polluted brackish waters (Braarud 1955, Gilet 1960, Hartman 1960, Hood 1958 1960, McNulty et. al. 1959, Mohr 1959, Reish 1957 1960, Zo Bell 1960 and others). However, because the effects of natural causes cannot be entirely separated, the use of laboratory experimentation becomes imperative.

Field Methods. Initially, six sampling stations (I-VI) were selected (Figure 12, Main Report). Choice was based upon previous studies (New Jersey-New York 1961, Jeffries 1962) and personal observations and communications. Samples were collected at approximately two week intervals. Sampling time did not exceed eight hours.

Phytoplankton. Water samples for subsequent phytoplankton analysis were taken at a 2-foot depth with a Kemmerer bottle. Two one liter amber bottles were filled and placed in the shade. One was kept under refrigeration overnight for analysis the next day. The other was used the same day for chlorophyll determination.

1-Bay - to include both Raritan Bay, Lower New York Bay and adjacent waters, unless specified otherwise.

A net sample was taken by towing a five inch diameter #20 net at slow speed for three minutes. The collected material was preserved in 5% formalin.

Benthos. Bottom samples were obtained employing a Petterson Dredge. The dredgings were placed in a large enamel tray. Odor, color, stratification and other observations were noted. After mixing, a one quart portion was preserved in 10% formalin for laboratory analysis.

Temperature. Surface temperatures were obtained from a bucket thermometer. A reversing thermometer was used for bottom temperatures. Bottom sediment temperatures were estimated by inserting a thermometer into the sediment immediately upon emptying the dredge. A battery operated field meter was used for measuring pH.

Light and Salinity. Light penetration was estimated with a Secchi disc. Salinity values were read directly by inserting the probe of a salinometer (corrected for temperature) into a bucket of sampled water.

Laboratory Analysis. Qualitative and quantitative estimates of phytoplankton were evaluated by counting in a Sedgwick-Rafter chamber. Taxonomy was determined from the net samples. Mr. A. Bleeker, Botany Dept., Rutgers University, obtained chlorophyll a values after the method of Richards with Thompson (1952).

Bottom materials were washed through eight inch diameter #4, #18 and #30 screens. The organisms were then washed into trays, picked out and sorted. Under low magnification, types, numbers and volumes of benthos were estimated.

Results - Phytoplankton - Species Composition and Seasonal Variation. Two separate patterns of phytoplankton community composition developed during the sampling period from September to December. Generally, flagellates dominated the flora in the late summer and early fall (Table B-2). Late fall began with two dominants, diatoms and greens, but diatoms later predominated. Between the two periods, composition was not distinctive to any one group. Protozoa occurred at all stations throughout the sampling period (Table B-2).

Peridinium trochoideum, a dinoflagellate, characterized the early pattern by being dominant at all stations except II and III (Table B-3). At these stations Skeletonema costatum, a diatom, was dominant. In the late fall, S. costatum, Coscinodiscus subtilis, and Nannochloris atomus, diatoms and a green algae predominated.

The phytoplankton populations were mainly characterized by

diatoms (Table B-3) yet flagellates and greens stand out at certain periods. From Table B-2, it is noted that more diatom species are found at the outer stations (II and III) than at the inshore stations (I, IV, V, VI). Station II appeared as having the most varied composition, while Station I varied the least. However, at this station dominance was shared by the greatest variation of different organisms. Station IV had the smallest variability among dominants.

On September 20, a distinct band of red water was observed approximately one mile off shore from Pt. Comofrt. This band, about 150-200 yards wide, ran NW-SE for approximately one-half mile, then curved rather sharply to the west and ran out of sight. The sharp delineation of the band from the surrounding water was emphasized by Secchi disc readings; inside the band the reading was 4.8 feet and less than three feet away the reading was 7.0 feet. The organism present which gave the water a red color was tentatively identified as a species of Goniaulax, a dinoflagellate. Members of this genus have been associated with "fish-kills" elsewhere. Patten (1961) observed red tides in the bay, but they were characterized by Massarita rotundata, a flagellate.

Abundance in Temporal and Spatial Distribution. Figures B-1 - B-6 give concentrations of phytoplankton cells/ml. Counts ranged from 10-843 cells/ml. Generally, there was a greater abundance in late summer, a sharp decline during October, and a rise at all stations in late fall. Station I exhibited the greatest abundance overall, while Station IV contained the fewest numbers. Greater fluctuations in numbers occurred at Station VI than at any other station (Figures B-1 - B-6).

On the average, more phytoplankton occurred in the waters along the upper part of the bay than along the lower. Further, there was generally greater abundance at the outer stations than at the inner. These figures, along with observations, also indicate that primarily the phytoplankton was recruited from areas outside of the bay. Hence the forms are oceanic and/or neritic. At certain times, however, populations indigenous to the inner bay (Stations I, IV-VI) dominate this area. During the late summer, Peridinium trochoideum, a dinoflagellate, occurred in more abundance at the four inner bay stations while Skeletonema costatum, a diatom, was most abundant at the outer stations (II, III). During December, an increase in abundance at the inner stations was marked by a rapid rise in numbers of a green form Nannochloris atomus. At the same time, S. costatum still dominated the outer stations. Observations also showed that while the inshore stations were dominated by a single organism, the associated diatom members of the population appeared in poor physiological condition, indicated by very small chromatophores and weak silicification of the frustules.

RARITAN BAY PROJECT

TABLE B-2. DOMINANT PHYTOPLANKTON TYPES

SEP.-DEC., 1962

Station	Sep 6	Sep 20	Oct 4	Oct 11	Oct 23	Oct 30	Nov 8	Nov 27	Dec 11
I	Dinofla- gellates Flagel- lates	Dinofla- gellates	Dinofla- gellates	Flagel- lates	No dominants	No dominants	Diatoms	Diatoms Green Algae	Green Algae Diatoms
II	Diatoms	Diatoms Flagel- lates	Diatoms Flagel- lates	Flagel- lates Diatoms	Diatoms	---	Diatoms	Diatoms	Diatoms
III	No dominants	Diatoms Dinofla- gellates	Diatoms	Diatoms Flagel- lates	---	---	No dominants	Green Algae	Diatoms
IV	---	Dinofla- gellates	Flagel- lates	Flagel- lates	Flagel- lates	No dominants	No dominants	Green Algae	Diatoms
V	Dinofla- gellates	Diatoms Dinofla- gellates	Flagel- lates	Flagel- lates	Diatoms Flagel- lates	Flagel- lates	Diatoms	Diatoms Green Algae	Diatoms Green Algae
VI	Dinofla- gellates	Dinofla- gellates	Flagel- lates	Flagel- lates	Flagel- lates	Green Algae	No dominants	Diatoms	Diatoms Green Algae

B-6-a

RARITAN BAY PROJECT

TABLE B-3. PHYTOPLANKTON GENERA AND SPECIES

September - December 1962

	Station ⁺									
Organism	I	II	IIA	III	IIIA	IV	V	VA	VI	
<u>Diatoms</u>										
Achnanthes sp.									X	
Actinoptylus undulatus (cf.)		X								
Asterionella japonica		X								
Biddulphia aurita		X								
Chaetoceros curvisetus		X*								
decipiens		X								
Chaetoceros sp.		X	X							
Corethron hystris		X		X		X			X	
Coscinodiscus excentricus		X*	X			X	X	X		
subtilis	X*	X	X*	X*	X*	X	X*	X*	X*	
Grammataphora marina (cf.)				X		X				
Gyrosigma acuminatum	X					X	X	X	X	
balticum		X				X	X	X		
Leptocylindricus danicus				X*		X				
minimus			X							
Licmophora sp.									X	
Lithodesmium undulatum		X	X							
Milosira salcata	X	X	X	X			X	X	X	
Navicula sp. (cf.)	X	X	X	X		X		X	X	
Nitzschia closterium		X		X						
seriata		X		X					X	
Nitzschia sp.		X			X		X		X	
Pediastrum sp.		X						X		
Rhizosolenia alata		X								
delicatulata		X								
hebetata semispina		X		X						
Schroderella sp. (cf.)	X						X			
Skeletonema costatum	X*	X*	X*	X*	X*	X*	X*	X*	X*	
Thalassionema nitzschioides		X					X	X		
Tropidoneis lepidoptera		X					X	X		

B-6-b

RARITAN BAY PROJECT

TABLE B-3. PHYTOPLANKTON GENERA AND SPECIES (Concl.)

September - December 1962

Organism	Station ⁺									
	I	II	IIA	III	IIIA	IV	V	VA	VI	
<u>Dinoflagellates</u>										
Amphidimium fusiforms	X			X						
Goniaulax sp.	X*					X				
Peridinum breve	X*	X	X	X*		X*	X*		X*	
trochoideum	X*	X	X	X*		X*	X*		X*	
<u>Others</u>										
Anacystis sp.	X*	X	X*			X		X	X*	
Eutreptia sp.	X			X		X*	X*		X	
Gomphosphaeria sp.	X						X		X	
Green flagellate I	X*	X	X	X	X	X	X	X	X	
Green flagellate II				X			X	X		
Nannochloris atomus (cf.) (green algae)	X*	X*	X*	X*	X*	X*	X*	X*	X*	
Silicoflagellates	X	X		X		X	X			
Protozoa	X	X	X	X	X	X	X	X	X	
TOTAL	17	24	29	20	6	16	19	15	18	

⁺ Station I-VI, samples beginning in September; station IIA, October; and IIIA and VA, December.

* = dominants

B-6-2

RARITAN BAY PROJECT BIOLOGICAL DATA

STATION I

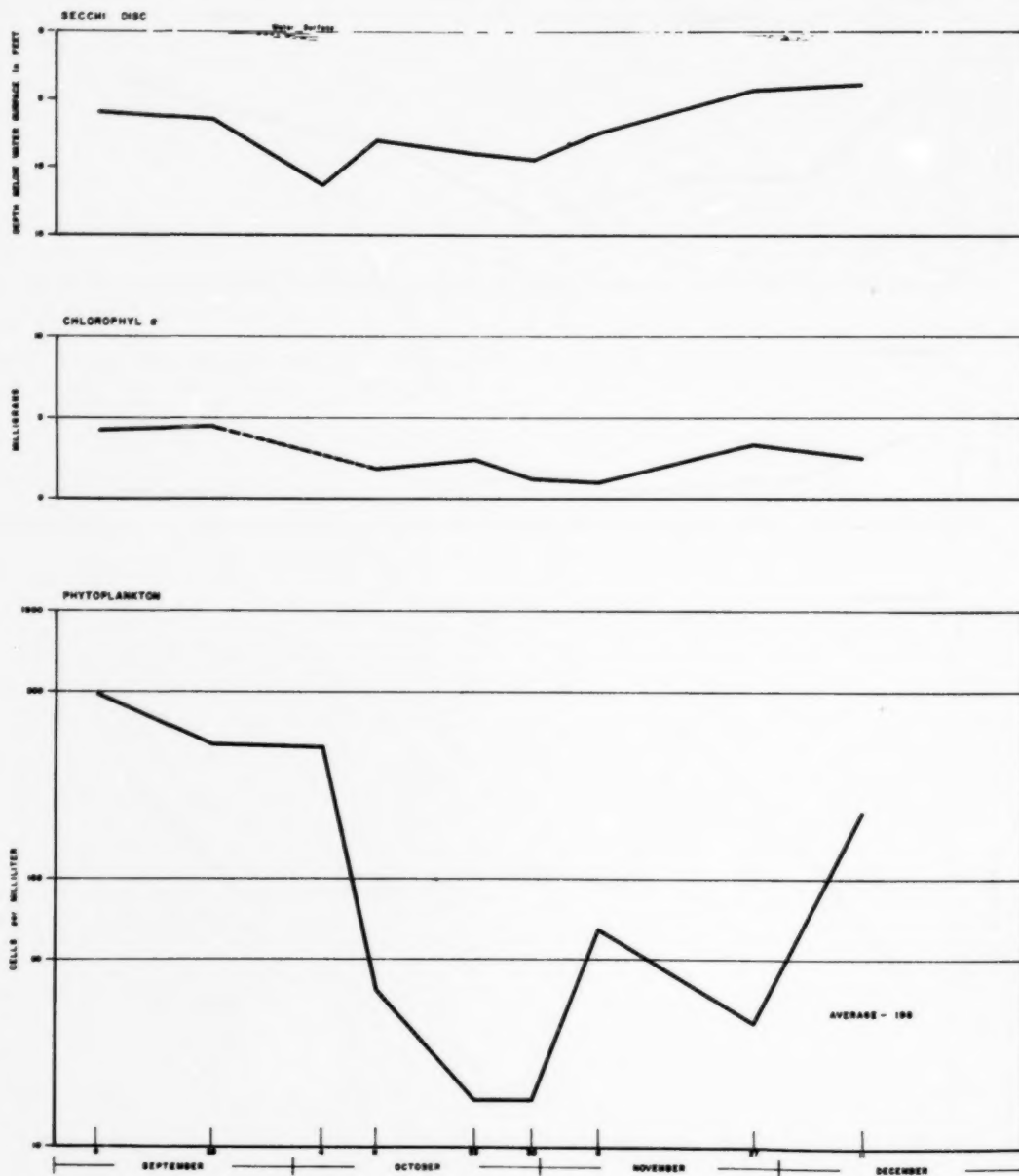


Figure B-1

B-6-d

RARITAN BAY PROJECT BIOLOGICAL DATA

STATION I

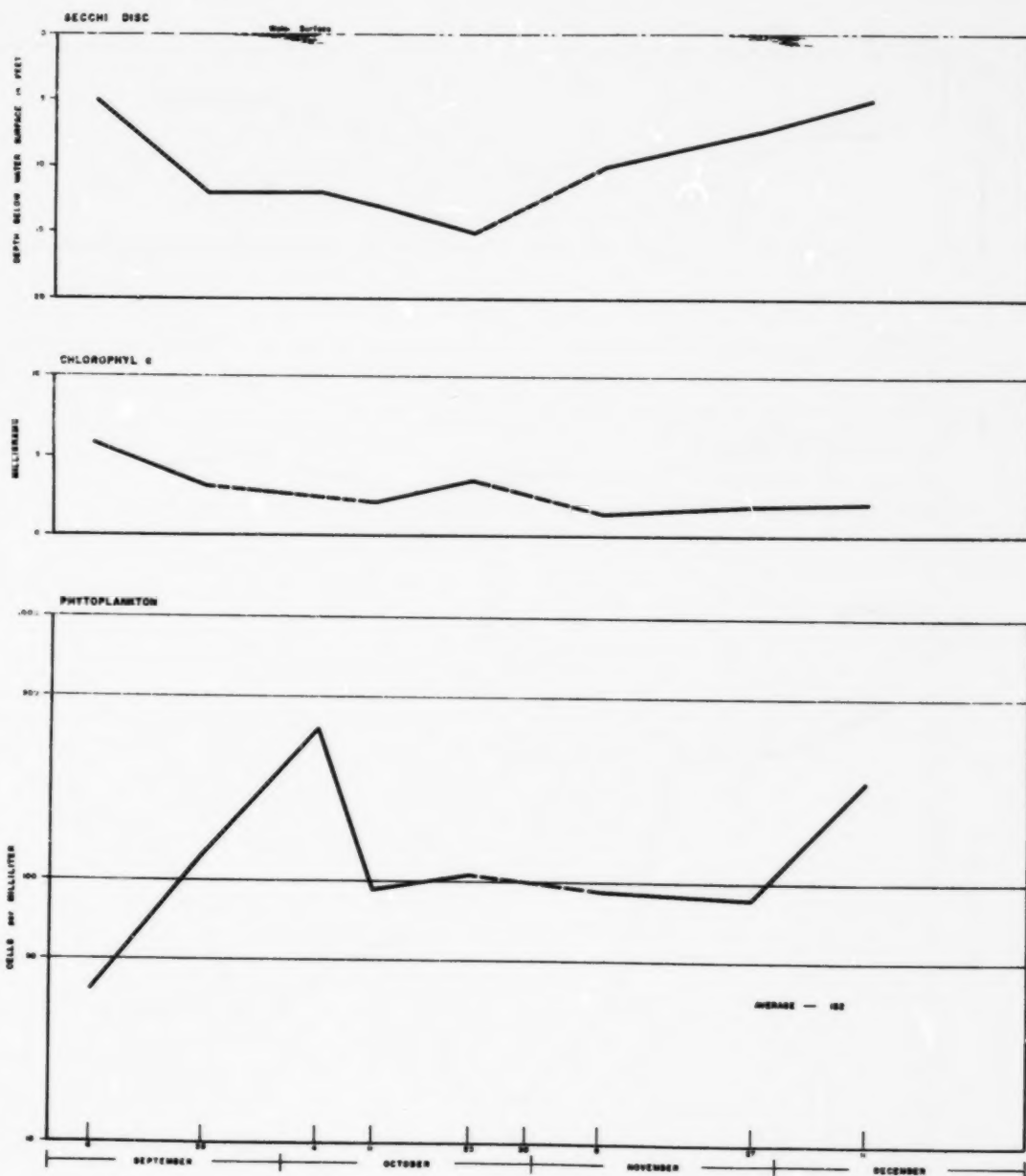


Figure B-2

B-6-e

RARITAN BAY PROJECT BIOLOGICAL DATA

STATION III

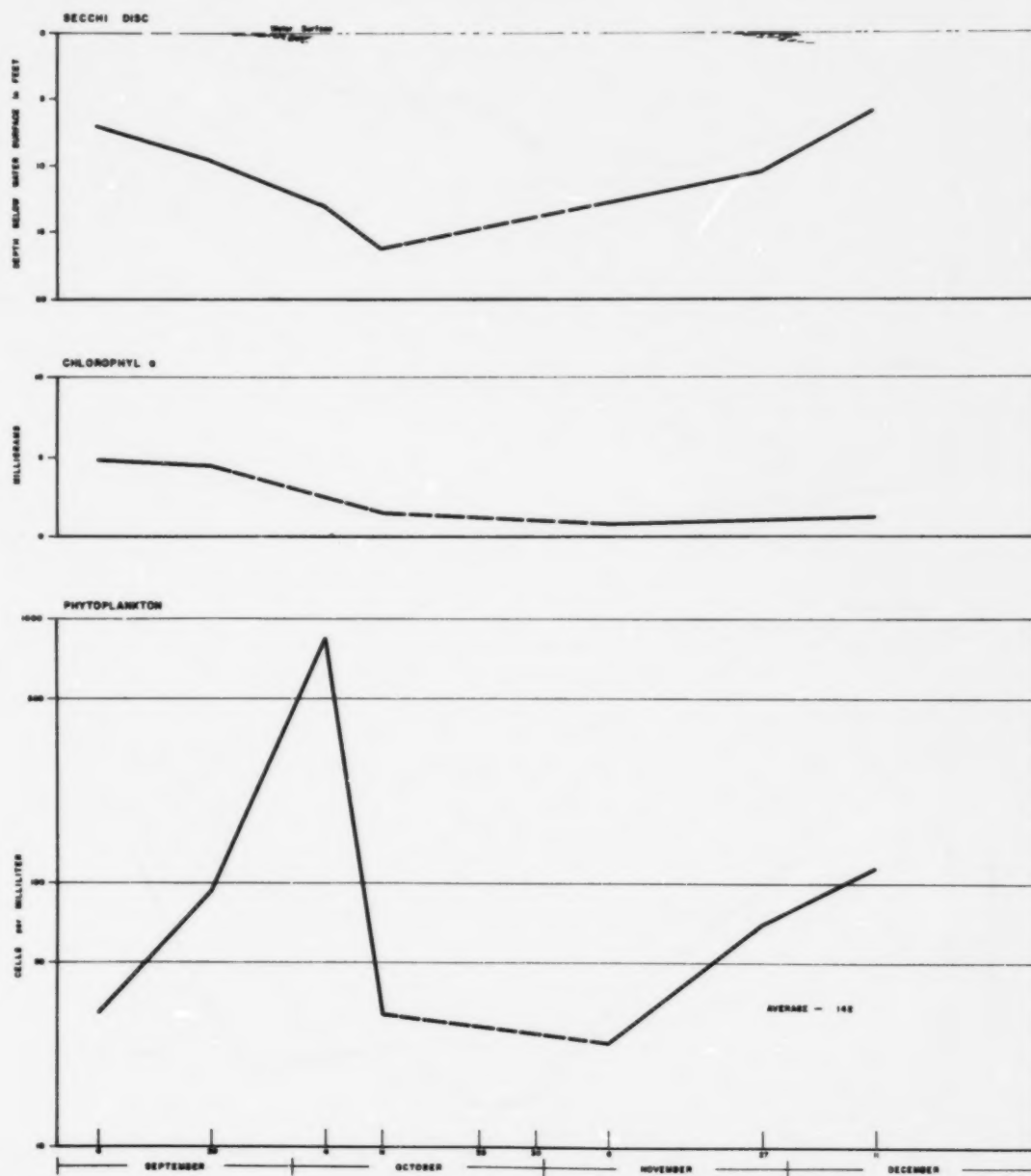


Figure B-3

B-6-f

RARITAN BAY PROJECT BIOLOGICAL DATA

STATION IV

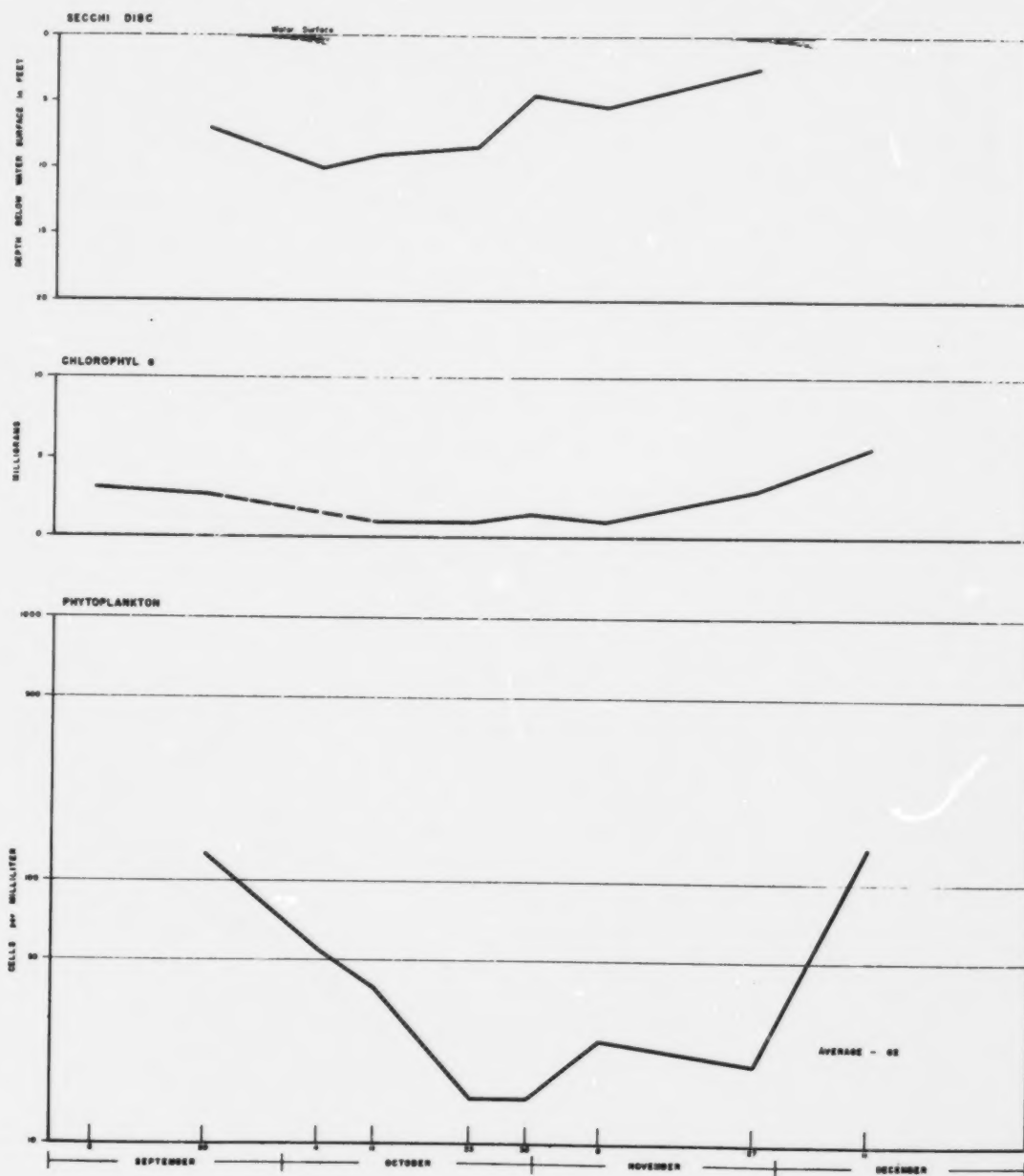


Figure B-4

B-6-g

RARITAN BAY PROJECT BIOLOGICAL DATA

STATION V

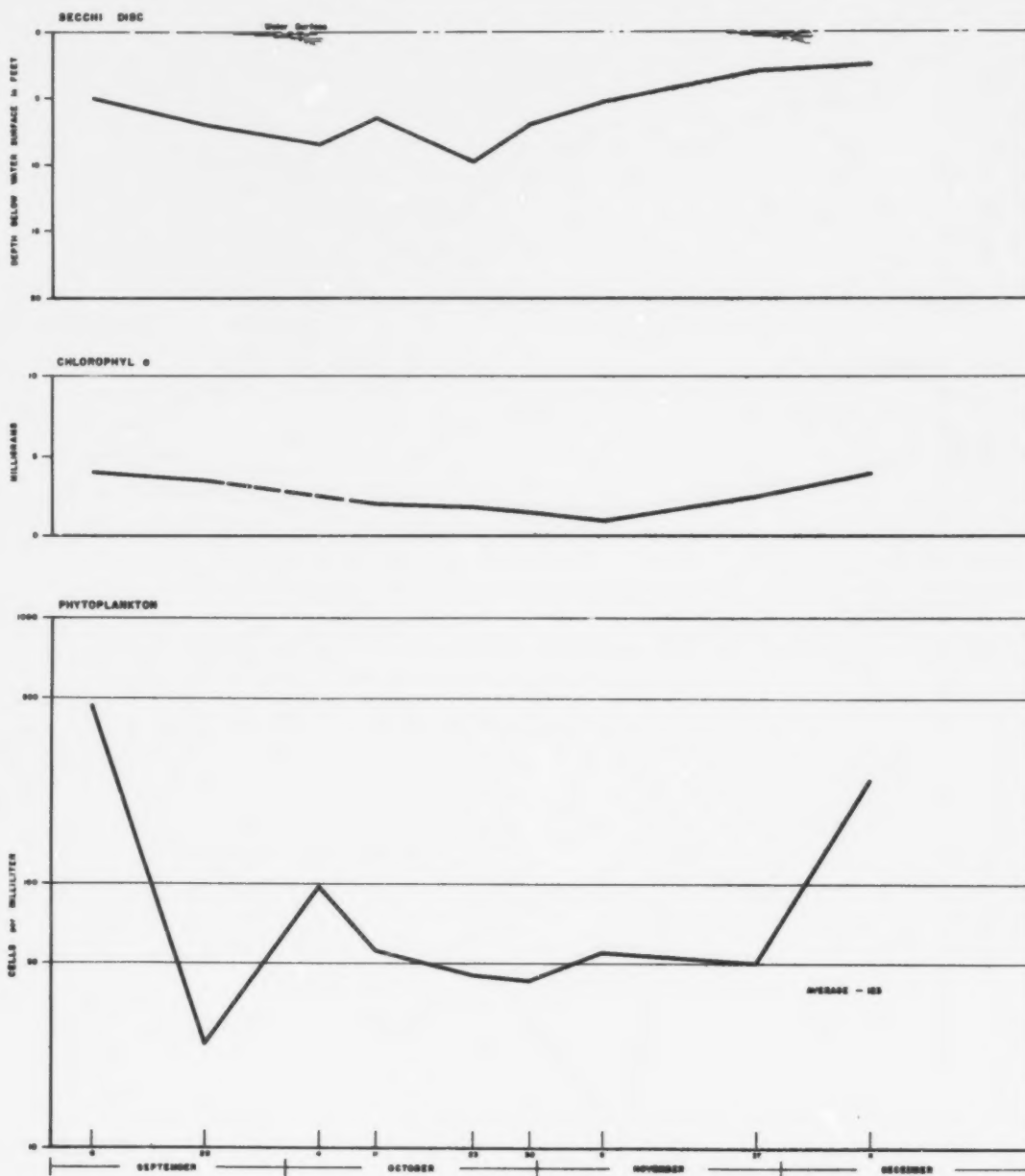


Figure B-5

B-6-h

RARITAN BAY PROJECT BIOLOGICAL DATA

STATION VII

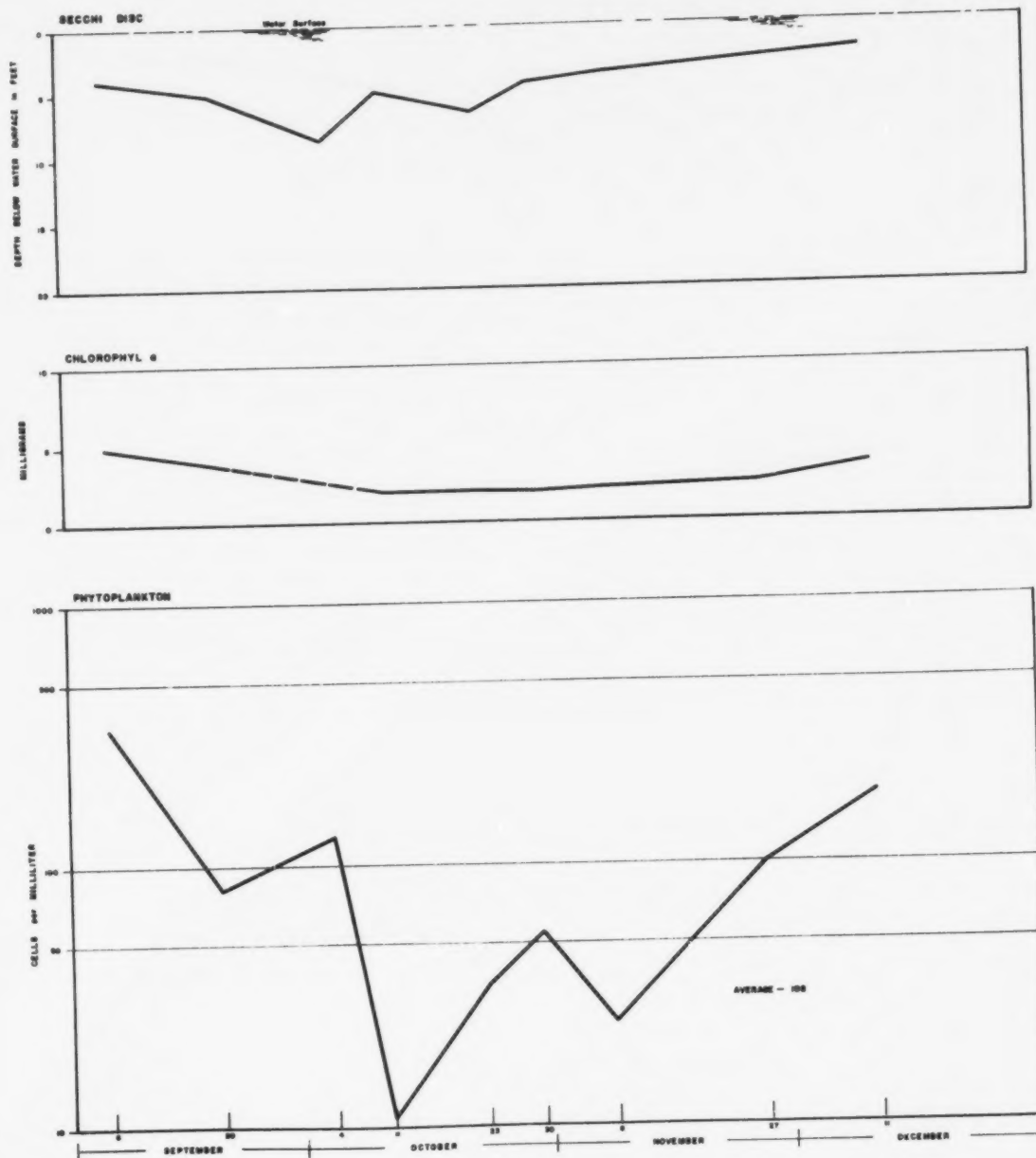
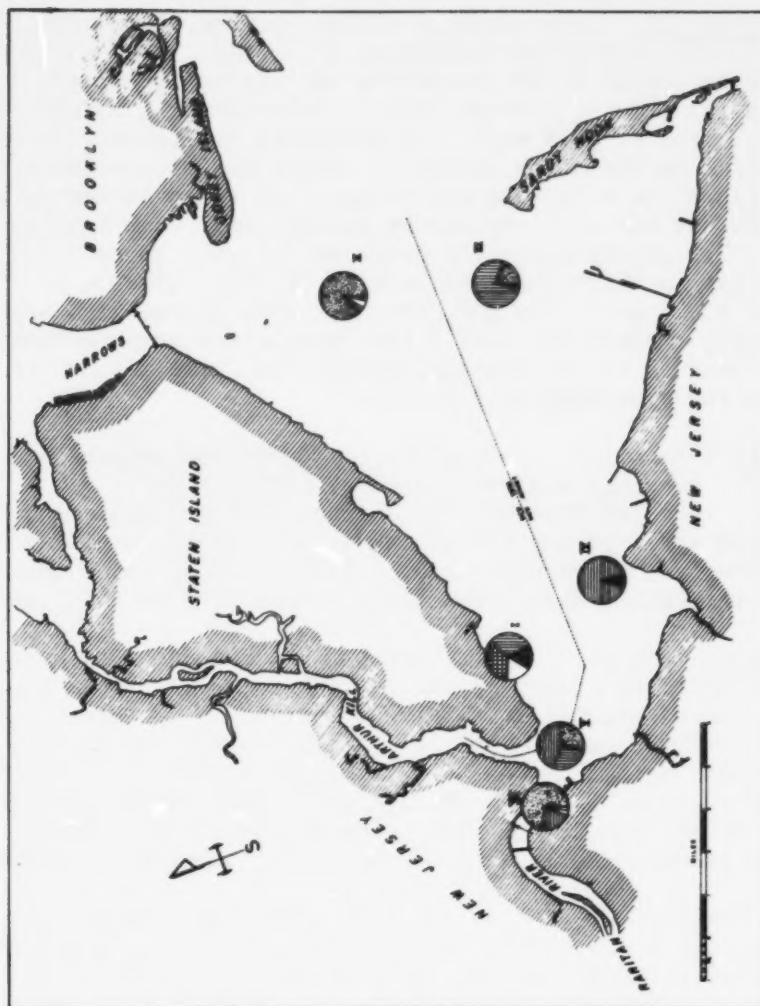


Figure B-6

B-6-i

RARITAN BAY PROJECT BENTHIC POPULATIONS COMMUNITY COMPOSITION



Percent of Total Benthic Populations

	STATION					
	I	II	III	IV	V	VI
Polychaeta	0	67	80	4	57	73
Mya arenaria	-	-	-	82	46	23
Amphipoda	30	4	76	3	28	-
Isopoda	36	2	<1	<1	1	2
Gastropoda	18	5	<1	<1	2	2
Others	0	2	2	-	-	-

B-6-f

Figure B-7

Chlorophyll. Chlorophyll a values for the associated phytoplankton counts are given in Figures B-1 - B-6. That chlorophyll and plankton counts do not correlate well is not an unusual condition in the estuary (Patten 1961). Chlorophyll a values ranged from 0.1 mg/l - 0.5 mg/l. By referring to Figure 7 in Odum (1959) where he lists the amount of oxygen assimilated/unit chlorophyll a/day for a "mixing environment" an estimate for O₂ production at the six stations can be calculated. Odum's values of 0.02 gm - 1.0 gm chlorophyll a produced 0.5 gm - 30 gm O₂/day when applied to chlorophyll amounts in the bay, give O₂ production values of 0.025 gm - .180 gm/L/day. It must be realized however, and strongly emphasized, that these amounts are gross estimates at best, because of fluctuations within the units themselves and the differences between environments.

Light Extinction. Generally, phytoplankton numbers and Secchi disc readings did not correlate (Figures B-1 - B-6). Observations revealed that the low Secchi readings (averaging 5 feet) were caused by large amounts of detritus, usually resulting from mixing after sustained high winds. Patten (1961) found the depths at which the Secchi disc disappeared ranged from 45 to 82 inches.

Benthos. At all stations except I, a red deposit, probably of iron origin, was found in the bottom sediments (Table B-4). Actually, this material is fairly widespread in the Bay (H. H. Haskins personal communication). Oil in the sediments was found also at Stations III, V and VI. Although not indicated in Table B-4, a strong H₂S odor developed in all samples after standing 24 hours under refrigeration. The lowering pH levels at Stations V and VI indicate slightly acid conditions of the bottom sediments.

One hundred per cent of all soil particles from each station passed through a #18 screen (1.00 mm mesh opening). Approximately 95% of that material also passed through a #30 screen (.59 mm). This indicates the soil classification to be fine sand particles and smaller silts or clays (Hough 1957). It is the particle size of bottom sediments which frequently determines the type of organisms living therein.

A different animal community existed at each of the stations sampled (Figure B-7). That four of these stations were dominated by a single group of organisms suggests the bottom area to be fairly stable. However, in the bay different benthic communities may exist at a distance of about 100 yards apart (H. H. Haskins personal communication). At each station 84% or more of the entire animal community was composed of three or less groups of organisms (Figure B-7). At Stations II, III and VI, a single group of organisms accounted for approximately 75% of the entire population.

The most common group of animals to all stations were the

polychaete worms (Figure B-7). Stations II and VI at opposite ends of the sampling area, were dominated by polychaetes, although the type of worm differed at the stations. It was observed that the polychaetes at Station II were of the Capitellid type, while at VI the Nereis type predominated. Amphipods also were common to all stations except VI. They accounted for 76% of the community at Station III and were numerically the second in order of abundance (Figure B-7).

At Station IV, a single organism Mya arenaria, the soft-shell clam, accounted for 92% of the population found there, also this was highest in abundance and density of any other organism or group of organisms at all stations (Table B-5). As yet no explanation can be given for the large density ($42,000/m^2$) at Station IV. The clams found at Station IV - VI probably represent this year's (1962) growth. At Station IV clam size ranged from 2-8 mm, while at V and VI it was 7-20 mm.

The greatest number of organisms were found at Stations III and IV, the least at VI. There appeared to be little difference among groups of organisms found at all stations (Figure B-7). However, the bivalves (pelecypods) excluding Mya arenaria, were excluded from the inner Stations IV and VI.

Abbiete (1957) found little or no macrophytic algae on the bottom sediments in the bay. Some algae occurred on pilings, buoy and lighthouse foundations and near shore substrates. The numbers of species declined towards the river.

Discussion - Phytoplankton. The low concentrations of phytoplankton in the bay during the sampling period (Figures B-1 thru B-6) suggests that factors separate from the natural environment may be responsible for the small amounts found. In comparison, in Narragansett Bay, Pratt (1959) found concentrations of 1,070-11,295 cells per ml during the late summer and fall. In Long Island Sound, Riley (1941) and Conover (1956) observed diatom blooms occurring from June - October.

Nutrients appear to be in large enough concentration (Jeffries 1962) and light penetration seemed sufficient, at least during October. At this time Secchi disc readings to 16 feet were recorded (Figures B-1 - B-6). The water was well mixed, no stratification was evident. Considering that phytoplankton composition changes periodically is no strong reason to explain the low populations here. There appeared to be sufficient light, nutrients and cells to sustain a much higher density. Further analysis of bay water and environmental variables may help to elucidate this matter.

At certain times extremely high turbidity resulted in low light penetration. The shallow euphotic zone resulting tends to

RARITAN BAY PROJECT

TABLE B-4. DESCRIPTIONS OF BOTTOM STATIONS

September 20, 1962

Station	Color	Composition	Odor	Observations	Salinity Parts Per Thousand	pH
I	Black Tan	Sand, silt, shells on top, small broken shells, small pebbles (1 mm), mud.	No H ₂ S Musty	Amphipod tubes (organic matter) 1 cm thick on top of sample. Few large <u>Mercenaria</u> .	26.8	6.9
II	Black	Sand, silt, cinders, ash, soot, large mussel shells almost cover bottom, some barnacles (all dead), mud.	H ₂ S Musty Moldy	Rust-like material in sediment.	28.0	6.8
III	Black Brown	Sand, silt, shells, sample composed of 40-50% amphipod tubes, mud.	Slight decay Musty Moldy	Oil and rust on top of settled sample.	27.4	6.9
IV	Black Brown	Sand, silt, slightly muddy, few amphipod tubes, mucky.	Chemical moldy	<u>Mya</u> on top 2 cm of bottom.	25.3	6.7
V	Brown on top Black	Sand, silt, small shell and pebbles, barnacles, worm houses (1 cm depth) on top of sediment, mucky.	Oil	Oil and rust on settled sample.	25.5	6.6
VI	Brownish red to 1 cm thick Black	Silt, lot of wood slivers, very mucky.	Septic	Oil and rust on settled sample.	24.6	5.9

B-4-a

RARITAN BAY PROJECT

TABLE B-5. BENTHIC POPULATIONS

September 20, 1962

Density per square meter

Organisms / Stations	I	Per- cent	II	Per- cent	III	Per- cent	IV	Per- cent	V	Per- cent	VI	Per- cent
ASCIDIA (sea-squirts)			++		+						++	
BRYOZOA			++									
COELENTERATA												
Anemone					312	1						
Hydra			++									
CRUSTACEA												
Amphipods	1248	30	125	4	18408	76	1248	3	1997	28		
Isopods	1498	36	62	2	125	41	62	41	62	1	62	2
Decapoda (Crab)	62	2			62	41	62	41				
MOLLUSCA GASTROPODA (snails)	749	18	187	5	250	41	374	1	125	2	62	2
PELagicPODA (excluding <u>Mya Arenaria</u>)	187	5	62	2	187	41						
<u>Mya Arenaria</u>							41870	92	2933	42	749	23
NEMATODES	++		++		++		++		++		++	
POLYCHAETA	312	8	3245	87	4742	20	1685	4	1934	27	2371	73
PORIFERA (sponges)	+								+			
TOTAL	4118		3744		24149		45302		7051			3307

+ Present, but not counted individually.

++ Abundant, but not counted individually.

50-80-6

reduce the amounts of chlorophyll and inhibits photosynthesis. The chlorophyll content in bay waters is less than half found in other estuaries (Odum 1959). It appears to be advisable to conduct primary production experiments to measure the relationship among light, chlorophyll and photosynthesis here in the bay.

The occurrence during late summer of Peridinium trochoideum, a dinoflagellate, and in late fall of Nannochloris atomus, a green algae, as dominants at the inner stations, as opposed to Skeletonema costatum at the outer stations suggests that factors peculiar to the inner bay support the growth of these organisms almost to the exclusion of others. In addition, the notable differences in dominants between the inner and outer bay at certain periods indicate that the supporting water masses are different. Provasoli (1960) suggests that phytoplankton populations (growth of) may be affected by amounts of organic micro-nutrients present.

Station IV, which is in the path of outflowing river water and of ebbing tides which carry waters from Arthur Kill, sustained the overall lowest phytoplankton concentration (Figures B-1 - B-6). The concentration of cells per ml was generally less than half that of the other stations.

The greatest fluctuation in phytoplankton density occurred at Station VI (Figure B-4). This may be due to the river influence.

Benthos. The most noticeable feature of the benthic communities was the domination of bottom associations by a single group of animals. The paramount example being the large abundance (42,000/m²) of Mya arenaria at Station IV.

When species diversity decreases and numbers of a single species increase, the ecosystem is regarded as developing toward a "climax" state. This climax condition means that the species present are the most tolerant or best "adapted" to the environment in which they are living. The less tolerant organisms do not survive. Usually in polluted or marginally polluted waters the benthic community is developing to the climax state. However, the climax condition is also present in healthy areas. Concerning the benthic fauna of the bay in regard to climax polluted conditions, no conclusions can be reached as yet. Further taxonomic study is necessary.

As with the phytoplankton, benthic fauna are signified as "indicator" organisms. It is well known that M. arenaria is able to tolerate low oxygen concentrations and other adverse environmental factors. Filicie (1959) describing an area of San Francisco Bay, divided the bottom fauna into zones. Among the organisms found in his marginal polluted zone were M. arenaria and various polychaetes. The same group of animals were found

at Stations IV - VI in Raritan Bay (Figure B-7). It is well to realize however, that this same assemblage is found in healthy bottoms to be sure, or there would be very little clam consumption.

It is not known if the large clam populations found at Stations IV and V reach adult size. There are several reasons for the doubt: (1) the large population competing for food in an area of low phytoplankton concentration, (2) oil found in the sediments (Table B-4) and the occasional "accidental" oil spillage in surrounding waters (oil clogs the feeding apparatus of the clam) and, (3) H. H. Haskins (personal communication) reports that bottom populations in the bay may shift location and change structure.

Reisch (1959) gives various accounts of investigators who assigned the polychaete Capitella capitata to areas strongly affected by domestic sewage. In the bay at Station II, the dominant group of animals were the polychaetes, many of which belonged to the genus Capitella. The definite species are unknown to the author at the present time.

Amphipods are commonly associated with shells and the tube forming types are known to exist abundantly in turbid waters (McKnulty et. al. 1959). The same conditions were found in the bay (Table B-4, Figure B-7).

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APPENDIX C

C-1

RARITAN BAY PROJECT

TABLE 1. BACTERIOLOGICAL DATA FOR STATIONS IN SHELLFISH AREA*

Densities per 100 milliliters

Station	CONFIRMED COLIFORM MPN			FECAL COLIFORM MPN			FECAL STREPTOCOCCUS		
	Number Samples	Median	Percent Above 230	Number Samples	Median	Percent Above 230	Number Samples	Median	Percent Above 230
1S	20	79	25	19	20	5	25	10	16
1D	20	90	30	19	27	11	18	20	11
2S	20	56	35	18	20	17	19	10	37
2D	20	41	35	17	20	18	24	35	29
3S	20	230	45	18	35	22	24	25	21
3D	19	80	42	16	65	25	17	10	35
28S	11	220	45	8	130	25	14	10	14
28D	13	240	62	9	220	44	17	70	29
29S	13	50	23	9	22	0	17	40	12
29D	13	79	15	9	33	0	15	10	0
30S	16	68	19	11	33	9	15	30	27
30D	15	110	33	12	30	17	20	30	25
31S	16	150	38	11	49	18	20	35	5
31D	16	79	31	12	36	17	15	30	7
45	5	70	20	5	11	0	6	30	17
46	4	33	25	4	13	25	5	10	20

RARITAN BAY PROJECT

TABLE 1. BACTERIOLOGICAL DATA FOR STATION IN SHELLFISH AREA* (Concl.)

Densities per 100 milliliters

Station	CONFIRMED COLIFORM MPN			FECAL COLIFORM MPN			FECAL STREPTOCOCCUS		
	Number Samples	Median	Percent Above 230	Number Samples	Median	Percent Above 230	Number Samples	Median	Percent Above 230
47	5	46	40	5	8	0	6	50	17
48	4	41	0	4	30	0	5	10	0
52	5	33	20	5	7	20	5	160	20
54	4	155	25	4	14	0	5	2300	80

* New York-New Jersey beds closed to shellfishing in May-June 1961.

RARITAN BAY PROJECT

TABLE 2. SEWAGE TREATMENT PLANT PERFORMANCE

Frequency Distribution

TOTAL CHLORINE RESIDUALS milligrams per liter						CONFIRMED COLIFORM density per 100 milliliters				
Percent equal to or less than						Percent equal to or greater than				
N	0.0	0.5	1.0	2.0	5.0	SEWAGE TREATMENT PLANTS	N	100	1000	10000
49 18	0 0	4 17	18 33	69 83	100 100	Oakwood Beach	46 18	33 33	17 22	2 0
69 30	1 3	3 17	9 33	30 67	96 100	Perth Amboy	69 30	16 63	3 37	1 10
78 18	12 11	41 39	73 72	90 83	100 100	Middlesex County	71 17	42 47	34 24	13 12
62 36	10 3	24 11	32 22	58 44	100 100	South Amboy	60 34	17 24	2 18	0 3
48 44	0 5	0 7	0 11	2 18	88 100	Keyport	42 41	5 37	0 20	0 10
51 40	12 0	39 10	49 28	65 75	100 100	Keansburg	45 42	67 52	33 33	9 17
51 49	18 0	29 6	33 8	49 20	82 98	Atlantic Highlands	46 43	59 19	48 7	22 2
75 44	7 2	8 11	13 18	24 36	96 98	Highlands	68 44	29 52	13 27	7 14

RARITAN BAY PROJECT

TABLE 3. SEWAGE TREATMENT PLANT DATA---24-HOUR SURVEYS JUNE - DEC 1962

Chemical Results									
Plant	Date	Flow (MGD)	BIOCHEMICAL OXYGEN DEMAND			TOTAL SUSPENDED SOLIDS			
			Pounds per day		Percent Reduction	Pounds per day		Percent Reduction	
			Influent	Effluent		Influent	Effluent		
Oakwood Beach	Aug 2	8.5	8,475 ^b	3,504 ^b		11,502	2,799		76
	Sep 27 ^a	11.6	11,014	1,663	85	28,184	4,814		83
	Average	10.0	11,014	1,663	85	19,843	3,806		81
Perth Amboy	Jul 26	5.6	13,240	11,682	12				
	Sep 13	6.8	16,669	11,470	31	9,807	3,810		61
	Nov 8	5.7	7,825	7,509	4	11,829	3,900		67
	Average	6.0	12,578	10,220	19	10,818	3,855		64
Middlesex County	Aug 16	40.8	191,000	157,000	18	123,000	25,400		79
	Sep 20	40.0	221,000	185,000	16	121,000	28,200		77
	Nov 29	48.0	176,600	161,000	9	157,700	44,100		72
	Average	42.9	196,000	168,000	14	134,000	32,600		76
South Amboy	Sep 6	0.91	1,197	924	23	1,430	336		76
	Nov 15	0.88	1,284	1,005	22	1,150	301		74
	Average	0.90	1,240	964	22	1,290	318		75
Keyport	Nov 2	0.65	1,211	712	41	735	258		65
	Dec 13	0.76	1,021	678	34	600	220		63
	Average	0.70	1,116	695	38	668	239		64

RARITAN BAY PROJECT

TABLE 3. SEWAGE TREATMENT PLANT DATA---24-HOUR SURVEYS JUNE - DEC 1962 (Concl.)

Chemical Results									
Plant	Date	Flow (MGD)	BIOCHEMICAL OXYGEN DEMAND			TOTAL SUSPENDED SOLIDS			
			Pounds per day		Percent Reduc- tion	Pounds per day		Percent Reduc- tion	
			Influent	Effluent		Influent	Effluent		
Keansburg	Aug 30 ^a	2.38	1,896	1,513	20	3,506	1,678	52	
	Oct 25	1.44	1,071	688	36	966	688	29	
	Average	1.91	1,483	1,100	26	2,236	1,183	47	
Atlantic Highlands	Aug 23	0.79 ^d	894	680	24	754	529	30	
	Oct 11	0.79 ^d	897	583	35	1,025	600	41	
	Average	0.79	896	632	29	890	564	37	
Highlands	Aug 9 ^a	1.44 ^d	868 ^c	1,054 ^c		2,911	1,648	43	
	Oct 4 ^a	1.44 ^d	1,575	829	47	1,574	995	37	
	Dec 6	0.55 ^d	1,309	288	78	356	216	39	
	Average	1.14	1,442	558	61	1,614	953	41	

^a Rain.

^b BOD ran for 15 hours - 3:00 P.M. 8/2/62 to 6:00 A.M. 8/3/62 - not included in average.

^c BOD ran for 17 hours - 1:40 P.M. 8/9/62 to 6:45 A.M. 8/10/62 - not included in average.

^d Estimated.

APPENDIX D

D-1

State of New Jersey

Dr. Roscoe P. Kandle - Commissioner of Health

Alfred H. Fletcher - Director, Division of Environmental Sanitation,
State Health Department

R. S. Shaw - Chief, Bureau of Public Health, State Health Department

E. R. Segesser - State Health Department

L. G. MacNamara - State Department of Conservation & Economic Development

State of New York

Dr. Hollis S. Ingraham - Commissioner of Health

A. F. Dappert - Director, Bureau of Water Resources Services, State
Health Department

I. Grossman - State Health Department

E. W. Montanari - Assistant Commissioner for Water Resources, Conservation
Department

David H. Wallace - Director of Marine Fisheries, State Conservation De-
partment

Harold F. Udell - State Conservation Department

Interstate Sanitation Commission

Dr. Natale Colosi - Chairman

Dr. Mitchell Wendell

T. R. Glenn, Jr. - Director and Chief Engineer

Louis J. Fontenelli - Vice Chairman

George T. Cowherd, Jr. - Assistant Chief Engineer

City of New York

Stanley Pinel - Office of Administration

Murray Herman - Office of Administration

Dr. George James - Commissioner of Health

Jerome Trichter - Assistant Commissioner of Health

City of New York (Cont'd).

Harold Romer - Director, Bureau of Sanitary Engineering, City Health Department

William T. Ingram - City Health Department

Raymond Siedlman - Senior Public Health Sanitarian, City Health Department

Meyer F. Wiles - Deputy Commissioner, General Manager, City Department of Public Works

William A. O'Leary - Director, Bureau of Water Pollution Control, City Department of Public Works

Alexander Wirin - City Department of Parks

Charles Samowitz - City Bureau of Budget

Public Health Service - Washington, D. C.

Murray Stein - Chief, Enforcement Branch, Division of Water Supply and Pollution Control

Peter G. Kuh - Chief, Interstate Enforcement Section, Enforcement Branch, Division of Water Supply and Pollution Control

Rheta Piere - Conference Co-ordinator, Enforcement Branch, Division of Water Supply and Pollution Control

K. E. Biglane - Assistant Chief, Eastern Operations, Technical Services Branch, Division of Water Supply and Pollution Control

William A. Felsing - Chief, Field Operations Section, Shellfish Sanitation Branch

Robert A. Taft Sanitary Engineering Center, Public Health Service

Dr. Paul W. Kabler - Chief of Microbiology, Basic & Applied Sciences Branch

Harold F. Clark - Chief Bacteriologist, Water Quality Studies, Basic & Applied Sciences Branch

Ralph Porges - Deputy Chief, Technical Advisory & Investigations Section, Technical Services Branch

F. W. Kittrell - Public Health Engineer, Pollution Evaluation, Field Operations Section, Technical Services Branch

Public Health Service - New York Regional Office

Dr. Harald M. Graning - Regional Health Director

Sylvan C. Martin - Assistant Regional Health Director, Environmental Health Services

Earl J. Anderson - Regional Program Director, Water Supply & Pollution Control

William H. Megonnell - Regional Program Director, Environmental Engineering & Food Protection

Thomas G. Frangos - Sanitary Engineer, Enforcement Section, Water Supply & Pollution Control

James H. McDermott - Sanitary Engineer, Basic Data Section, Water Supply & Pollution Control

Donald S. Baker - Assistant Sanitary Engineer, Basic Data Section, Water Supply & Pollution Control

Sidney E. Clark - Assistant Sanitary Engineer, Construction Grants Section, Water Supply & Pollution Control

Ronald Macomber - Shellfish Program, Environmental Engineering & Food Protection

Robert E. Linkner - Assistant Sanitary Engineer, Shellfish Program, Environmental Engineering & Food Protection

Aaron Englisher - Regional Public Health Representative for Grants Management

Public Health Service - Raritan Bay Project

Paul DeFalco, Jr. - Project Director

Juan M. Ramos - Chief, Laboratory Branch

Stanley G. Monroe - Senior Sanitary Engineer

Kenneth H. Walker - Senior Assistant Sanitary Engineer

Francis Brezenski - Bacteriologist

John Bacharz - Bacteriologist

William E. Miller - Chemist

Dale B. Parke - Assistant Sanitary Engineer

Public Health Service - Raritan Bay Project (Cont'd)

Ralph R. Wirth - Assistant Sanitary Engineer

Charles L. Brown - Marine Biologist

Bernard R. Sacks - Assistant Sanitary Engineer

Stuart F. Somers - Assistant Sanitary Engineer

Public Health Service - Delaware Estuary Comprehensive Study

E. L. MacLeman - Project Director

Public Health Service - Northeast Shellfish Sanitation Research Center

Robert Campbell - Aquatic Biologist

Public Health Service Consultants

Dr. Warren Litsky

Dr. Bernard Newman

Gerald Palevsky

Federal Agencies

Commander W. C. Dahlgren - U. S. Coast Guard

William H. Wechter - Sanitary Engineer, First Army Engineers

Stanley Wechsler - Hydraulics Engineer, U. S. Army Engineers District,
New York

Warren S. Landers - Fishery Biologist, Bureau of Commercial Fisheries
Shellfish Laboratory

Richard W. Sherman - Special Assistant for Sanitary Engineering, Third
Naval District, New York

S. Allen Betts - U. S. Naval Ammunition Depot, Earle, N. J.

President's Advisory Board (Water Pollution Control)

Charles H. Callison - Member and Assistant to the President, National
Audubon Society

Raritan Valley Sewerage Authority

Walter J. Kling - Chief Operator

New Jersey Joint Sewer Commission

Edward P. Decher - Executive Director

Matthew Krafte

Middlesex County Sewerage Authority

Anthony J. Popowski - Chairman

Sol Seid - Chief Engineer

Ariel A. Thomas

Oyster Institute of North America

Elizabeth M. Wallace - Executive Director

Stanley Cottrell

John M. Parsons

North Jersey Commercial Fishermen's Association

Martin Feldman

Civic Associations

Dr. I. L. Small - League of Women Voters, Summit, N. J.

Mrs. William H. Rossell - League of Women Voters, New York

J. H. Bennett - President, New Dorp & Grant City Taxpayers Association

Mrs. Norma Cirella - Vice President, New Dorp & Grant City Taxpayers
Association

Gwendolyn M. Compton - Raritan Anti-Pollution Association

Universities

Dr. H. Heukelekian - Rutgers University, New Brunswick, N. J.

R. Manganelli - Rutgers University, New Brunswick, N. J.

Harvey Lieber - Brooklyn College, Brooklyn, N. Y.

James Pfafflin - The Cooper Union, New York, N. Y.

W. Rowe - Student, The Cooper Union, New York, N. Y.

Industries

W. L. Mann - Staff Assistant to Plant Manager, National Lead Co., Titanium Division

A. W. Sitarski - Humble Oil & Refining Co.

Daniel P. Grace - Engineering Supervisor, Humble Oil & Refining Co.

Fred Greene - Humble Oil & Refining Co. (Bayway Refinery)

A. P. Dennis, Jr. - Humble Oil & Refining Co. (Bayway Refinery)

R. E. Thurn - Product Quality Coordinator, California Oil Co.

Ralph Schmidt - American Cyanamid Co.

A. J. Gabaccia - American Cyanamid Co.

M. H. Klegerman - Alexander Potter Associates (Civil Engineers)

Francis Charles - Plant Manager, General Aniline & Film Corp.

Charles F. Bien - Pollution Control Engineer, General Aniline & Film Corp.

J. H. Morris - Merck & Co., Inc.

E. E. Drapp - Engineer, Alcoa

Robert C. Moore - Vice President, E. T. Killam Associates (RVSA)

Jack Marshall - President, Ekroth Laboratories

Dale T. Mayrose - General American Transportation Corp.

Lincoln Peschiera - National Lead Co., Titanium Division

Thomas Chinili - Ocean View Seafood Co.

Lloyd L. Falk - E. I. DuPont de Nemours & Co., Inc., Engineering Department

Robert G. Hand - Cities Service Oil Co.

J. S. Baum - Cities Service Oil Co.

Press

John J. Reilly, Jr. - World Telegram & Sun

Anna Peterson - New York Times

Press

Ian E. McNett - Perth Amboy Evening News

J. Ridgeway - Assistant Editor, New Republic Magazine

J. W. Ludlum - New Jersey State Chamber of Commerce

Eugene F. Craig - Executive Assistant, Borough President's Office

Elaine A. Kovessy - Legislative Assistant to Congressman J. M. Murphy,
16th C. D.